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Founded by W. A. Kellerman, J. B. Ellis, and B. M. Everhart in 1885

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Because of the amount of original manuscript on hand and the increased cost of paper and printing, no separate index to this volume will be issued, but a complete index to the first ten volumes of MYCOLOGIA will be published at the close of 1918

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EDITOR

WILLIAM ALPHONSO MURRILL

Vol. IX—JANUARY, 1917—No. 1

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THREE DOLLARS A YEAR

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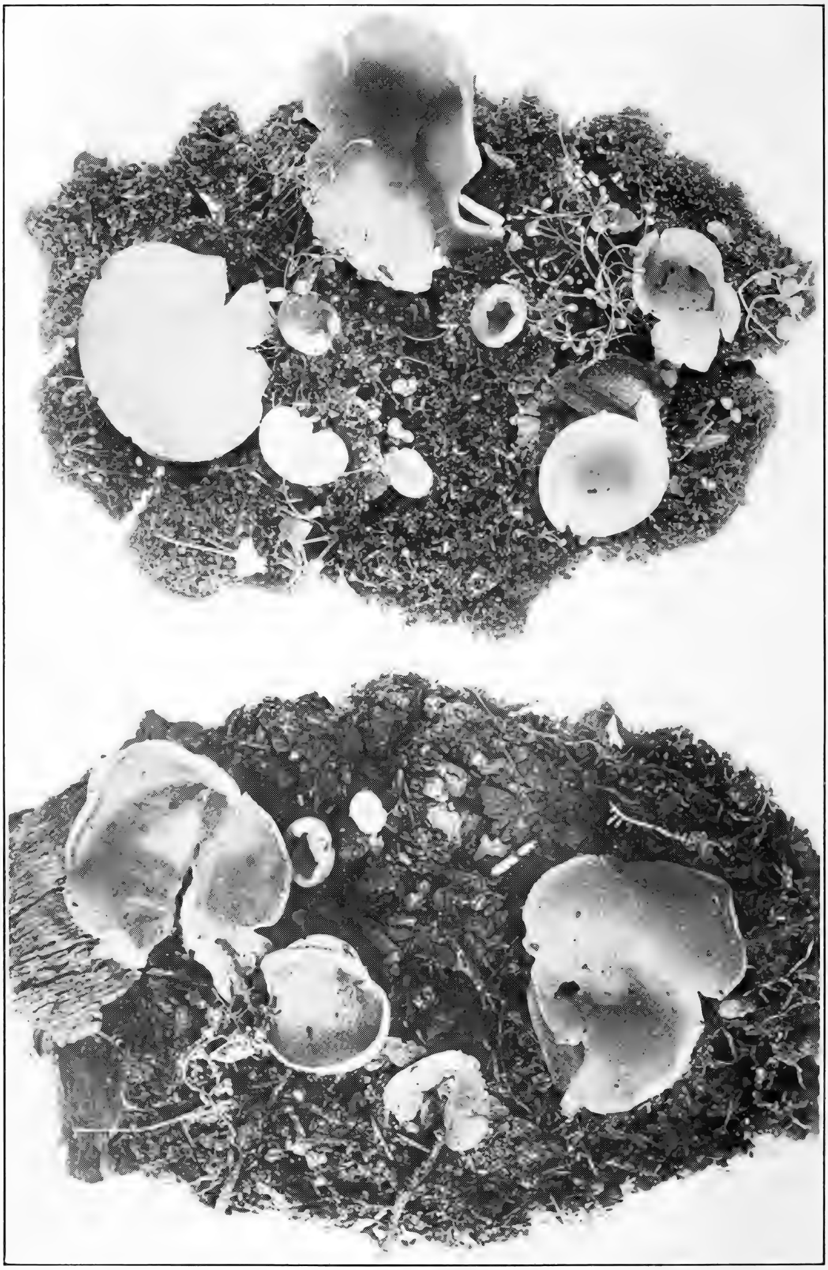

PEZIZA PROTEANA (BOUD.) SEAVER
PEZIZA VIOLACEA PERS.

MYCOLOGIA

Vol. IX — January, 1917 — No. 1

PHOTOGRAPHS AND DESCRIPTIONS OF CUP-FUNGI—V. PEZIZA PROTEANA AND PEZIZA VIOLACEA

Fred J. Seaver

(With Plate 1, Containing 2 Figures)

During the summer of 1915, several collections were made of a *Peziza* which agrees with Boudier's description and illustration of *Aleuria proteana*. The species occurs on old burnt places which have been thoroughly overrun with mosses. The apothecia when young are beautiful waxy-white but with age become slightly colored, smoky or with a tinge of pink, which occasionally runs over to lilac.

The habitat, size, and character of the spores would indicate a close relationship with *Peziza violacea,* a species which is comparatively common on charcoal beds and recently burned places. The latter species, however, has a deep-violet hymenium which in aged specimens is almost black, the contrast in color being so marked that the plants could scarcely be referred to the same species, although their similarity in other respects cannot escape notice. The following descriptions and photographs have been drawn from fresh material collected in the outskirts of New York City.

Peziza proteana (Boud.) Seaver

Aleuria proteana Boud. Bull. Soc. Myc. Fr. **15**: 50. 1899.
Galactinia proteana Sacc. Syll. Fung. **16**: 709. 1902.

Apothecia sessile, cup-shaped, finally more or less repand, en-

[Mycologia for November (8: 293–337) was issued November 3, 1916.]

tirely white when young, becoming overcast with a faintly reddish or lilac tint, reaching a diameter of 3–6 cm.; hymenium concave, becoming plane or convex and usually umbilicate, color varying from white when young to rosy, pale-violet, or slightly brownish; asci cylindric or subcylindric, reaching a length of 225–250 μ and a diameter of 10 μ; spores 1-seriate or slightly crowded, small, ellipsoid, usually containing two small oil-drops, smooth, becoming sculptured, $5–7 \times 12–13 \mu$; spore-sculpturing assuming the form of minute warts or papillae; paraphyses slender, septate, enlarged above, where they reach a diameter of 7–8 μ.

On old burnt places which have been overrun with mosses.

TYPE LOCALITY: France.

DISTRIBUTION: New York and Texas; also in Europe.

ILLUSTRATION: Bull. Soc. Myc. Fr. **15**: *pl. 3, f. 1*; Boud. Ic. Myc. *pl. 293*.

Peziza violacea Pers. Syn. Fung. 639. 1801

Peziza Boltoni Quél. Bull. Soc. Bot. Fr. **25**: 290. 1878.
Aleuria violacea Gill. Champ. Fr. Discom. 47. 1879.
Peziza ampelina Quél. Grevillea **8**: 116. 1880.
Humaria violacea Sacc. Syll. Fung. **8**: 149. 1889.
Aleuria Boltoni Gill. Champ. Fr. Discom. 206. 1886.

Apothecia gregarious, sessile or substipitate when young, at first closed and subglobose, gradually expanding, becoming shallow cup-shaped, discoid, or occasionally repand, at first regular in form, becoming irregular, the margin often splitting, externally at first white, finally becoming pale-violaceous, reaching a diameter of 3 or 4 cm., although often much smaller; hymenium concave, plane, or convex, pale-violet when young, becoming deep-violet with age, finally almost black, even or slightly uneven and usually umbilicate; substance very soft and brittle; asci cylindric or subcylindric, gradually attenuated below, reaching a length of 200–250 μ and a diameter of 12–15 μ, 8-spored; spores 1-seriate, or irregularly disposed, ellipsoid, usually containing two small oil-drops, hyaline, becoming sculptured, $8 \times 12–13 \mu$; spore-sculpturing consisting of very minute warts; paraphyses slender, septate, enlarged above, usually curved and filled with violet granules, reaching a diameter of 8 μ at their apices.

On burnt places and on charcoal beds.

TYPE LOCALITY: Europe.

DISTRIBUTION: New York to Wisconsin; also in Europe.

ILLUSTRATION: Grevillea 8: pl. *131, f. 4*; Bolton, Gesichte 3: *pl. 99, f. a*; Boud. Ic. Myc. *pl. 276*.

NEW YORK BOTANICAL GARDEN.

FUNGI AND LICHENS FROM THE ISLAND OF GUAM

Paul Weidemeyer Graff

With the opening up of the Pacific to trade and travel, the natural sequence of events brings about a more universal interest, both general and scientific, regarding the region. From a botanical standpoint our knowledge is as yet extremely limited. A few isolated localities have been worked over to some extent, but even in these places much remains to be accomplished. In the Marianne Islands, of which Guam is the largest, only a few botanical collections of any extent have been made.

These islands are located, approximately, between 13° to 20° north latitude and 143° to 146° east longitude. The island of Guam itself is about 46 kilometers long and 16 wide at its broadest part; this, however, is not in a central location as the island is more or less dumb-bell shaped and only about 5 kilometers broad in the region of Agaña, the chief town. From San Francisco by way of Honolulu, as the boats ordinarily travel, the islands are about 8,670 kilometers distant and are about 2,440 kilometers east from Manila. As is true of a large percentage of the Pacific islands, the Marianne Islands are of volcanic origin.

The island of Guam was discovered by Ferdinand Magellan, during his voyage of circumnavigation, on March 6, 1521, a short time before his fatal visit to the Philippines. The first botanical collection was not made until 1792, when Thaddeus Haenke and Luis Née of the Malaspina Expedition, with which they were connected as botanists, visited the islands. They spent between February 12th and 24th at Guam but there is no record of any fungi having been preserved by them from that place. In fact, but three fungi have been reported as being collected by them on the entire voyage. Two of these were gathered in Mexico and the other in the Philippine Islands. With this list might also be mentioned the fact that nineteen lichens from the American continent, mostly from Peru and Chili, make up the entire

list of fungi collected by these two botanists. The next collection of Guam plants was made by Adelbert de Chamisso de Boncourt, botanist of the Romanzoff Expedition, which visited the place in November, 1817. His collection, though containing numerous flowering plants and ferns, contained no fungi from these islands. It seems strange that while the Philippines, Hawaii, Chili, Brazil, and a number of other places are represented by specimens in his fungous collection, Guam should have been slighted in this respect. It may have been that the stay of the Expedition here was very short or material of this class of plants may have been neglected while here.

The first expedition on which any specimens of fungi were gathered and preserved was that under the command of Louis Freycinet, which visited Guam in March, 1819, a little more than a year after Chamisso. The expedition had been joined by Charles Gaudichaud-Beaupré as physician and botanist and it was through his efforts that an extensive botanical collection was made. Several months were spent in the exploration of Guam and the neighboring islands of Rota and Tinian. The expedition made what was probably the largest single collection to date in the botanical exploration of Guam. Unfortunately, however, on the return voyage their vessel, the "Uranie" foundered while in the Falkland Islands. The hold in which the herbarium was stored became flooded and more than half the botanical collections were destroyed.

Among the remaining material there are sixty-seven species designated as fungous specimens, of which twenty-five are credited to the Marianne Islands and the larger portion of the remainder to the following localities: Rio de Janeiro, Isle of France, Rawak, and the Hawaiian Islands. The number classed as lichens is slightly larger, being ninety-seven in all, of which eighteen are from the Marianne Islands. The arrangement, classification, and description of new species in both the fungi and lichens was published by Persoon between 1826 and 1830 and a goodly percentage were described by him as new. Of this material all but thirteen are recognizable and will be found distributed in proper order in the list to follow. The uncertain species include the following and have been omitted: *Lycogala marianna, Sphaeria laguncula,*

Himantia nodulosa, Porinia tessellata, Ophegrapha cymbiformis, O. cincta, Ctesium album, C. rugosum, Gyrophora perforata, Collema ulvaceum, C. peltigera, C. stellare, and *Physica fastigiata.* It will be noted that a considerable number of species given by Persoon in his fungous list are now known to be lichens and will be found under lichen genera in the portion of this paper following.

Montagne, in 1843 and 1856, published among notes on other fungi a few scattered ones on some species collected by Gaudichaud, all of which are in the herbarium of the Paris Museum. A few lichens also received attention but among the several species mentioned nothing was reported new to the islands.

No further reference to Guam fungi can be found till 1901, when Schumann and Lauterbach published their "Flora der Deutschen Schutzgebiet in der Sudsee." They include an enumeration of six fungi and three lichens. This enumeration does not seem to designate plants collected during this voyage but rather to have been taken, for the most part, from Gaudichaud's publication. The Marianne Islands are not mentioned in their itinerary and were probably not visited. The fungi listed by them include *Auricularia auricula-judae* (L.) Schrot., for which they consider Persoon's Guam type *A. ampla* a synonym and suggest that probably his *A. ornata* should receive a similar classification. Under *Fomes scabrosus* (Pers.) Fr., they include Persoon's two Guam species, *Polyporus scabrosus* and *P. fuscobadius. Polyporus mariannus* Pers. is considered by them as *P. kamphoveneri* Fr., and is so listed. *Polyporus sanguineus* L., *P. saccatus* Pers., and *Agaricus alneus* L., as reported by Persoon, are given under the names *Polystictus sanguineus* (L.) Mey., *P. xanthopus Fr.,* and *Schizophyllum alneum* (L.) Schroet., respectively. Among the lichens *Dictyonema membranaceum* Agardh., *Coenogonium linkii* Ehrenb., and *Ramalina subfraxinea* Nyl., are enumerated from this locality.

In 1905 Safford published in his "Useful Plants of Guam" a short list of six species of fungi which is identical with that of Schumann and Lauterbach, exclusive of their lichens, and is very evidently based on their list rather than any collection of his own or even on Gaudichaud's record. This is the last published list

with the exception of one by the present writer, included in Merrill's "Enumeration of the Plants of Guam," in 1914.

In this last named article the writer, with an unfortunate lack of literature, attempted a list of the then known species from the island. Gaudichaud's publication was inaccessible, hence only his species as included by Schumann and Lauterbach and Safford could be included and *Fomes lignosus* was erroneously given in the list. To these were added several recent collections which are preserved in the herbarium of the Bureau of Science, Manila. In all, this enumeration included eighteen species of fungi, one of which, *Cladosporium clemensiae,* was described as new. While this article was short and imperfect with the exclusion of lichens, it more than doubled the known species of fungi from Guam.

The present enumeration is warrented by the inclusion of all known species of fungi and lichens from the island, with the exception of several doubtful species which are listed at the end, and the hope that it may form a basis for future work on the fungus flora of this locality. This enumeration includes Gaudichaud's species which are deposited in the herbarium of the Paris Museum, material collected by Mrs. Mary S. Clemens in 1911 and R. C. McGregor during the same year, and specimens communicated by the Guam Experiment Station. These last are all preserved in the herbarium of the Bureau of Science in Manila where they were examined and identified.

FUNGI

PHYLLACHORA Nitschke

PHYLLACHORA AFZELIAE Syd. Philip. Journ. Sci. Bot. **8**: 277. 1913

Guam Experiment Station 324, on leaves of *Intsia bijuga* (Colbr.) O. Kuntze (*Afzelia bijuga* A. Gray).

Described from the Philippine material collected on the same host. As yet only reported from the Philippines and Guam.

AURICULARIA Bull.

AURICULARIA ORNATA Pers. in Gaud. Bot. Freyc. Voy. Uranie 177. *pl. 2, fig. 4.* 1826

Helvella mesenterica Dicks. Plant. Crypt. **1**: 20. 1785.

Auricularia tremelloides Bull. Hist. Champ. Fr. *278. pl. 290.* 1791–98.
Auricularia violacea Bull. in l. c.
Thelephora mesenterica Pers. Syn. Fung. 571. 1808.
Thelephora purpurea Pers. in l. c.
Auricularia corrugata Sowerb. Engl. Fungi 290. 1797–1815.
Phlebia mesenterica Fr. Elench. Fung. **1**: 154. 1828.
Oncomyces mesentericus Klotz. Linnaea **7**: 195. 1832.
Auricularia mesenterica Fr. Epicr. Myc. 555. 1838.
Auricularia pusio Berk. Journ. Linn. Soc. Bot. **17**: 386. 1879.

Mary S. Clemens s. n., in the vicinity of Agaña, November 27, 1911, on dead tree branches. Gaudichaud, in the herbarium of the Paris Museum.

Auricularia ornata Pers. is considered by Schumann and Lauterbach in their enumeration of Guam fungi as a synonym of *Auricularia auricula-judae* (L.) Schroet., together with *Auricularia ampla* Pers., also described from Guam material. Their opinion will, however, hardly be accepted.

A fungus of very general tropical and subtropical distribution, in both eastern and western hemispheres.

HIRNEOLA Fries

HIRNEOLA AMPLA (Pers.) Fr. Fungi Nat. 26. 1848

Auricularia ampla Pers. in Gaud. Bot. Freyc. Voy. Uranie 177. 1826.
Exidia nobilis Lév. Ann. Sci. Nat. III. Bot. **2**: 218. 1844.
Exidia ampla Lév. Ann. Sci. Nat. III. Bot. **5**: 159. 1846.
Hirneola nobilis Fr. Fungi Nat. 26. 1848.

Gaudichaud, in herb. Paris Mus.

This fungus has been collected in India, the Moluccas, Philippines, Japan, and in Guiana. It, in all probability, will prove of very general tropical distribution when better known.

HIRNEOLA AURICULA-JUDAE (Fr.) Berk. Outl. Brit. Fung. 289. 1860. Fr. Hym. Eur. 695. 1874

Exidia auricula-judae Fr. Syst. Myc. **2**: 221. 1823.
Tremella auricula L. Sp. Pl. **2**: 1157. 1753.

Tremella sessilis Thunb. Flor. Japon. 345. 1784.
Peziza auricula L. Syst. Veg. Ed. XV. 1018. 1789.
Tremella auriformis Hoffm. Veg. Crypt. 31. *pl. 6, fig. 4.* 1790.
Auricularia sambucina Mart. Flor. Crypt. Erlang. 459. 1817.
Auricularia auricula Underw. Mem. Torr. Bot. Club **12**: 15. 1902.

1911. R. C. McGregor 588, October, 1911. Guam Experiment Station 304.

A very common species in all warm countries of the tropics and neighboring regions.

Hirneola nigricans (Hook.) comb. nov.

Peziza nigricans Hook. in Knuth Syn. Plant. **1**: 13. 1822.
Exidia hispidula Berk. Ann. Mag. Nat. Hist. I, **3**: 396. 1839.
Hirneola hispidula Sacc. Syll. Fung. **6**: 769. 1888.

Guam Exp. Sta. 424, Thompson, May, 1912.

Previously collected in the northern portion of South America, also in Mauritius, Australia and Ceylon.

POLYPORUS Micheli

POLYPORUS MARIANNUS Pers. in Gaud. Bot. Freyc. Voy. Uranie 173. 1826

Polyporus anebus Berk. Hook. Lond. Journ. Bot. **6**: 504. 1847.
Gaudichaud, in herb. Paris Mus.

Schumann and Lauterbach cite *Polyporus mariannus* Pers. as a synonym of *P. kamphoveneri* Fr. With this Murrill does not agree (Bull. Torr. Bot. Club **34**: 468. 1907), but considers the species identical with *P. corrugatus* Pers. It seems probable, however, that it is the same species Berkeley described from Ceylon as *P. anebus*. In this opinion Lloyd (Synopsis Apus Polyporus 382. 1915), who has critically studied much of the basidiomycetous material in the Paris Museum, concurs. As Persoon's name was given the fungus some twenty years prior to Berkeley's, its use should be accepted.

First described from the Marianne Islands. Also collected in Africa, Ceylon, Japan and the islands of the Pacific.

FOMES Fries

Fomes lineatus (Pers.) comb. nov.

Polyporus lineatus Pers. in Gaud. Bot. Freyc. Voy. Uranie 174. 1826.

Polyporus fastuosus Lév. in Gaud. Bot. Voy. Bonite **1**: 180. 1846.

Fomes fastuosus Cooke, Grevillea **14**: 18. 1886.

Gaudichaud, in herb. Paris Mus.

This species was omitted from the lists of both Schumann and Lauterbach, and Safford. As is true of a number of tropical forms, this species may only develop a single hymenial layer but often develops a greater number and hence becomes a Fomes. The possibility of an entire collection from a locality being of one type while another might show the further development of a Fomes has been one of the causes of multiplicity of names in the synonymy of many tropical species. *Pyropolyporus fastuosus* Murr., as first published (Murrill in Bull. Torr. Bot. Club **34**: 179. 1907) for Philippine material, was applied to *Fomes spadiceus* (Berk.) Cooke instead of *F. fastuosus* (Lév.) Cooke, as is shown by the duplicate material in the herbarium of the Bureau of Science, Manila, where both species of the fungus are common.

Collected in the Malay States, Moluccas, Philippines and the Marianne Islands.

FOMES NUBILUS Fr. Epicr. Myc. 491. 1838, var. *albo-limbatus* Kalchbr. Grevillea **10**: 55. 1881

McGregor 589, October, 1911. Guam Exp. Sta. 266.

Previously known only as an African species which had been collected in the Congo and Guinea.

POLYSTICTUS Fries

POLYSTICTUS AFFINIS (Nees) Fr. Nov. Act. Reg. Soc. Sci. Ups. III. **1**: 75. 1855

Polyporus affinis Nees, Nov. Act. Acad. Nat. Cur. $\mathbf{13}^1$: 18. *pl. 4, fig. 1.* 1826.

McGregor 590, October, 1911.

A species intermediate between *Polystictus xanthopus* Fr. and *P. flabelliformis* Kl., and very closely related to *P. luteus* Bl. and Nees, from which it is separated by its smaller size and more delicate character.

Of very general distribution throughout the tropics and one of the most common species to be found in this region.

POLYSTICTUS OCCIDENTALIS (Kl.) Fr. Nov. Symb. Myc. 90. 1851

Polyporus occidentalis Kl. Linnaea **8**: 486. 1833.
Trametes lanatus Fr. Epicr. Myc. 490. 1838.
Trametes occidentalis Fr. Epicr. Myc. 491. 1838.
Trametes wahlbergii Fr. Fungi Natal. 11. 1848.
Trametes scalaris Fr. Fungi Natal. 12. 1848.
Polyporus scorteus Fr. Nov. Symb. Myc. 89. 1851.
Trametes devexa Berk. Journ. Linn. Soc. **13**: 165. 1873.
Polyporus illotus Kalchbr. Grevillea **10**: 102. 1882.
Coriolopsis occidentalis Murr. Bull. Torr. Bot. Club **32**: 358. 1905.

Guam Exp. Sta. 303.

This much described species is of very general distribution throughout the tropics.

POLYSTICTUS SANGUINEUS (L.) Fr. Nov. Symb. Myc. 75. 1851

Boletus sanguineus L. Spec. Plant. Ed. II, 1646. 1763.
Xylometron sanguineum Paul. Icon. Champ. *pl. 3, figs. 3, 4.* 1793.
Agaricus ruber Lamk. Encyc. Met. Bot. **1**: 50. 1783.
Polystictus sanguineus Mey. Flor. Esseq. 304. 1818.
Polyporus sanguineus Pers. in Gaud. Bot. Freyc. Voy. Uranie 170. 1826.
Polyporus flaccidus Pers. in Gaud. Bot. Freyc. Voy. Uranie 171. 1826.
Polyporus ampliporus Fr. Elench. Fung. **1**: 99. 1828.
Pycnoporus sanguineus Murr. Bull. Torr. Bot. Club **31**: 421. 1904.

Guam Exp. Sta. 300.

The distribution of this fungus is universal throughout the

tropics and it is a form of the temperate species *Polystictus cinnabarinus* (Jacq.) Fr. It makes no discrimination as to the kind of wood upon which it will grow, being omnivorous in that respect.

POLYSTICTUS XANTHOPUS Fr. Nov. Symb. Myc. 74. 1851

Polyporus xanthopus Fr. Obs. Myc. **2**: 255. 1815–18. Syst. Myc. **1**: 505. 1821.

Boletus katui Ehrenb. in Nees, Hor. Phys. Ber. 93. *pl. 19, fig. 12.* 1820.

Polystictus saccatus Pers. in Gaud. Bot. Freyc. Voy. Uranie 169. *pl. 1, fig. 3.* 1826.

Polystictus cupro-nitens Kalchbr. Thüm. Myc. Univ. n. 1702.

Polystictus crassipes Curr. Flor. Pug. 122.

Gaudichaud, in herb. Paris Mus.

Of general tropical distribution and particularly common through the Indian and Polynesian regions. Closely related to *Polystictus affinis* Nees and *P. perula* (Beauv.) Fr., though having the stipe central rather than lateral, and with several other related species of the "Polystictus perula Group" very common on all sorts of host material in the Malayan islands.

POLYSTICTUS XANTHOPUS Fr. var. florideus (Berk.) Bres. Hedwigia **53**: 61. 1912

Polyporus florideus Berk. Hook. Journ. Bot. and Kew Gard. Misc. **6**: 137. 1854.

Polystictus mukuensis Cooke, Grevillea **16**: 25. 1887.

Polystictus luteus (Bl. & Nees) Fr., var. *bukobensis* P. Henn. Engl. Bot. Jahrb. **17**: 27. 1893.

Guam Exp. Sta. 194.

The specimens of this collection have all the characters of the variety, including the slightly larger size of the pores which average 66 by 116 μ, except the color of the top of the pileus. This is pallid and of a light golden brown color. One collection of a fungus identical with this has been made in the Philippine Islands and has also been placed, at least for the present, as belonging to this variety. It is questionable if these are not as worthy of a

varietal name as those already known as var. *florideus* or, at least, of being distinguished from them as forma *pallidus*. Both the Philippine and Guam collections show uniformity and as yet no gradations between these different cases have been found.

So far as known this pale form has only been collected in the Philippine Islands and Guam. The usual form is rather common in the Malayan region and the Asiatic tropics but not found with near the frequency of the species.

TRAMETES Fries

TRAMETES CORRUGATUS (Pers.) Bres. Hedwigia **51**: 316. 1912

Polyporus corrugatus Pers. in Gaud. Bot. Freyc. Voy. Uranie 172. 1826.

Polyporus fusco-badius Pers. in l. c.

Polyporus scabrosus Pers. in l. c.

Daedalea sanguinea Klotz. Linnaea **8**: 481. 1833.

Polyporus indecorus Jungh. Flor. Crypt. Java 51. 1838.

Polyporus tegularis Lév. Ann. Sci. Nat. III. Bot. **5**: 131. 1846.

Hexagonia cruenta Mont. Syll. Gen. Spec. Crypt. 169. 1856.

Polystictus persoonii Cooke, Grevillea **14**: 85. 1885.

Trametes nitida Pat. Journ. Bot. **4**: 17. 1890.

Earliella cubensis Murr. Bull. Torr. Bot. Club **32**: 479. 1905.

Earliella corrugata Murr. Bull. Torr. Bot. Club **34**: 468. 1907.

Guam Exp. Sta. 301. Gaudichaud, in herb. Paris Mus.

A much described species of universal tropical distribution. Reported notably from West Africa, India, Ceylon, Java, Borneo, Sumatra, the Philippines, Guam, Australia and the American tropics. The species was first described from material collected in Guam by Gaudichaud-Beaupré.

HEXAGONIA Fries

HEXAGONIA BIVALVIS (Pers.) Bres. Hedwigia **51**: 318. 1912.
var. puchella (Lév.) Bres. Hedwigia **53**: 73. 1912

Hexagonia pulchella Lév. Ann. Sci. Nat. III. Bot. **2**: 200. 1844.

Guam. Exp. Sta. 423.

First described from material collected in Java. Since reported from Malacca, Mauritius and the Philippines. The va-

riety proves to be of much more frequent occurrence than the species.

LASCHIA Fries

LASCHIA PHILIPPINENSIS Graff, Philip. Journ. Sci. Bot. **8**: 300. 1913.

Agaña, Clemens, November 27, 1911, on dead twigs.

The type of this species was also collected by Mrs. Clemens, but on Mount Maquiling, Luzon, in the Philippine Islands. A comparison of this material with the type leaves no question of their identity.

So far as known this species has only been collected in the Philippines and Guam.

SCHIZOPHYLLUM Fries

SCHIZOPHYLLUM COMMUNE Fr. Syst. Myc. **1**: 330. 1821

Agaricus radiatus Vaill. Bot. Paris 10. 1727.
Agaricus alneus Linn. Flor. Suec. n. 1242. 1745–55.
Agaricus multifidus Batsch, Elench. Fung. Contin. **1**: 124. *fig. 126.* 1786.
Scaphophorus agaricoides Ehrb. in Nees Horae Phys. Berol. 94. 1820.
Schizonia vulgaris Pers. Myc. Eur. **3**: 14. 1822–28.
Schizophyllum alneum Schroet. in Cohn Krypt. Flor. Schles. **3**: 383. 1887.

Guam. Exp. Sta. 302.

This is probably one of the most widely distributed of all basidiomycetous fungi. It is apparently found throughout all tropical and temperate regions.

LENTINUS Fries

LENTINUS VELUTINUS Fr. Linnaea **5**: 510. 1830

Agaricus strigopus Pers. in Gaud. Bot. Freyc. Voy. Uranie 167. *pl. 1, fig. 6.* 1826
Lentinus capronatus Fr. Epicr. Myc. 388. 1838.
Scleroma velutinum Fr. Epicr. Myc. 392. 1838.
Lentinus setiger Lév. Ann. Sci. Nat. III. Bot. **2**: 176. 1844.

Lentinus braccatus Lév. in Zoll. Syst. Verz. Ind. Arch. 17. 1854–55.

Guam Exp. Sta. 425.

Persoon's name is antedated by *Lentinus strigopus* (Schw.) Fr., reported by Schweinitz from Carolina, and hence is not valid.

Collected in tropical South America, the West Indies, United States and the Philippine Islands.

COPRINUS Persoon

COPRINUS HEMEROBIUS Fr. Epicr. Myc. 253. 1838

Agaricus campanulatus Bolt. Hist. Fung. 31. 1788–91.
Agaricus bubulinus Schum. Enum. Plant. Sael. 2: 352. 1801–03.

Guam Exp. Sta. 329.

This species is very evidently related to *Coprinus plicatilis* (Curt.) Fr., as found in the Philippine Islands. It has, however, a longer stipe and a glabrous cap. Mature spores of the Guam material average $8.7 \times 12.5\,\mu$ and show a tendency toward being apiculate.

Previously reported from various localities in Europe.

NAUCORIA Fries

NAUCORIA PUSIOLA Fr. Hym. Eur. 258. 1874

Agaricus pusiolus Fr. Syst. Myc. 1: 264. 1821.
Agaricus laevis Pers. Myc. Eur. 3: 164. *pl. 25, fig. 1.* 1822–28.

Guam Exp. Sta. 330.

Spores broadly elliptical in the Guam material, sometimes becoming irregularly elliptical, averaging $6 \times 7.8\,\mu$, light brown in color.

Previously collected in Europe and Australia.

PHOMA Fries

PHOMA LUSITANICA Thüm. Contr. Myc. Lusit. 335

Vicinity of Piti, McGregor 406a, October, 1911, on twigs of *Glossogyne tenuifolia* (Less.) Cass.

Spores $2 \times 4\,\mu$ in perithecia averaging $95\,\mu$ wide and $130\,\mu$ high, including the ostiole.

Previously collected in Lusitania by Moller.

CLADOSPORIUM Link

CLADOSPORIUM CLEMENSIAE Graff, Philip. Journ. Sci. Bot. 9: 40. 1914

Vicinity of Agaña, Clemens, November 27, 1911, on leaves of *Eragrostis tenella* (L.) R. & S.

Found in great quantities on the under surface of the leaves and occasionally on the upper in dark brown spots. The vegetative hyphae is light in color, septate and branches irregularly. Conidiophores erect, simple, fuscous, seldom more than three or four in a cluster. Color is given to the spots by the conidiophores and spores which are dark brown.

As yet only known from Guam.

CLADOSPORIUM FASCICULATUM Corda, Icon. Fung. Cog. 15. *pl. 4, fig. 216.* 1842

Vicinity of Piti, Guam Exp. Sta. 4a, Thompson, November, 1910, on *Dactyloctenium aegyptiacum* Willd.

Reported from both Europe and Asia.

LICHENES

PSEUDOPYRENULA Müll.

Pseudopyrenula tessella (Pers.) comb. nov.

Verrucaria tessella Pers. in Gaud. Bot. Freyc. Voy. Uranie 183. 1826–30.

Varrucaria ochroleuca Eschw. in Mart. Icon. Sel. *pl. 8, fig. 3, 4.* 1828.

Trypethelium ochroleucum Nyl. Flora 126. 1869.

Pseudopyrenula ochroleuca Wainio, Lich. Brésil 209. 1890.

Gaudichaud, in herb. Paris Mus.

Collected in tropical America, India, the Federated Malay States, and Guam.

PSEUDOPYRENULA TROPICA (Ach.) Müll. Arg. Lich. Beitr. 602. 1883

Verrucaria tropica Ach. Lich. Univ. 278. 1810.

Verrucaria gaudichaudii Fée, Essai Crypt. Ecore. 87. *pl. 22, fig. 4.* 1824.

Pyrenula gaudichaudii Pers. in Gaud. Bot. Freyc. Voy. Uranie 182. 1826–30.
Sagedia tropica Massal. Ric. Lich. Crost. 161. 1852.
Trypethelium tropicum Müll. Arg. Pyr. Cub. 393. 1885.

Gaudichaud, in herb. Paris Mus.

Reported from tropical Africa, Malaya, and tropical Asia.

BOTTARIA Massalongo

BOTTARIA VARIOLOSA (Pers.) Wainio, Lich. Brésil 197. 1890

Pyrenula variolosa Pers. in Gaud. Bot. Freyc. Voy. Uranie 181. 1826–30.
Verrucaria variolosa Mont. Syll. Crypt. 368. 1861.
Anthracothecium variolosum Müll. Linnaea **43**: 44. 1880.

Gaudichaud, in herb. Paris Mus.

Probably a well distributed species. Reported from Cuba, Brazil, Mexico, Guam, and tropical Africa.

ARTHONIA (Acharius) Zahlbr.

ARTHONIA VIOLACEA Pers. in Gaud. Bot. Freyc. Voy. Uranie 187. 1826–30

Gaudichaud, in herb. Paris Mus.

As yet only reported from localities in Polynesia.

GRAPHIS (Adanson) Müll.

GRAPHIS CONTEXTA (Pers.) Nyl. Bull. Soc. Linn. Norm. II. **2**: 81. 1868

Emblemia contexta Pers. in Gaud. Bot. Freyc. Voy. Uranie 184. 1826–30.
Emblemia venosa Mont. Ann. Sci. Nat. III. Bot. **10**: 129. 1848.

Gaudichaud, in herb. Paris Mus.

Collected in tropical Africa, southern Asia, and the islands of the Pacific.

GRAPHIS HETEROCARPA Nyl. Lich. Japon. 114. 1890

Opegrapha heterocarpa Fée, Essai Crypt. Exot. **1**: 29. 1824.
Graphis scripta Ach., var. *ochroleuca* Pers. in Gaud. Bot. Freyc. Voy. Uranie 183. 1826–30.

Gaudichaud, in herb. Paris Mus.

A species of very cosmopolitan distribution, both tropical and temperate.

GRAPHIS LABYRINTHICA Ach. Syn. Lich. 107. 1814

Stictis dispar Pers. in Gaud. Bot. Freyc. Voy. Uranie 178. 1826–30.

Sarcographa labyrinthiformis Belang. Voy. Ind. Orient. Crypt. 137. 1846.

Gaudichaud, in herb. Paris Mus.

Found in the American tropics, Malaya, and East Africa.

COENOGONIUM Ehrenb.

COENOGONIUM CONTROVERSUM Pers. in Gaud. Bot. Freyc. Voy. Uranie 214. 1826–30

Coenogonium linkii Ehrenb., var. *leprieurii* Mont. Ann. Sci. Nat. III. Bot. **16**: 47. 1851.

Coenogonium leprieurii Nyl. Ann. Sci. Nat. IV. Bot. **16**: 89. *fig. 15–19.* 1862.

Gaudichaud, in herb. Paris Mus.

Collected in tropical South America, New Caledonia, Mauritius and East Africa.

LECIDEA Acharius

LECIDEA FURFURACEA Pers. in Gaud. Bot. Freyc. Voy. Uranie 192. 1826–30

Lecidea sanguineo-atra Nyl., var. *furfuracea* Nyl. Enum. Lich. 121. 1857.

Collected in the American tropics and islands of the Pacific.

LEPTOGIUM (Acharius) S. Gray

LEPTOGIUM TREMELLOIDES (Linn.) Wainio, Lich. Brésil 209. 1890

Lichen tremelloides Linn. Syst. Veget. Suppl. 450. 1781.

Lichen azureus Sw. Flor. Ind. Occ. 3: 1895. 1806.

Collema mariannum Pers. in Gaud. Bot. Freyc. Voy. Uranie 203. 1826–30.

Leptogium mariannum Mont. in Gay Hist. Fis. Polit. Chile **8**: 226. 1852.

Leptogium azureum Nyl. Lich. N. Zeland 10. 1888.

Gaudichaud, in herb. Paris Mus.

A plant of very broad tropical and semitropical distribution.

PANNARIA Delacroix

PANNARIA PANNOSA (Ach.) Nyl. Syn. Lich. 2^1: 29. 1863.

Parmelia pannosa Ach. Syn. Lich. 329. 1814.

Parmelia marianna Fr. Syst. Orb. Veg. 284. 1825.

Pannaria marianna Müll. Arg. Lich. Beitr. 1159. 1887.

Gaudichaud, in herb. Paris Mus.

Reported from Brazil, East Africa, Malacca, Java, and other Pacific islands.

COCCOCARPIA Pers.

COCCOCARPIA INCISA Pers. in Gaud. Bot. Freyc. Voy. Uranie 206. 1826–30.

Coccocarpia molybdaea Pers., var. *incisa* Nyl. Syn. Lich. **2**: 43. 1885.

Gaudichaud, in herb. Paris Mus.

Collected in tropical America, Java, Malacca, and the Adaman Islands.

COCCOCARPIA PELLITA (Ach.) Müll. Arg. Lich. Beitr. 421. 1882

Parmelia pellita Ach. Lich. Univ. 468. 1810.

Coccocarpia molybdaea Pers. in Gaud. Bot. Freyc. Voy. Uranie 206. 1826–30.

Pannaria molybdaea Tuck. Syn. N. Am. Lich. **1**: 124. 1882.

Gaudichaud, in herb. Paris Mus.

Collected in Brazil, Peru, Japan, Malacca, Java, and East Africa.

COCCOCARPIA PELLITA (Ach.) Müll., var. smaragdina (Pers.) Müll. Flora **1882**: 421. 1882

Coccocarpia smaragdina Pers. in Gaud. Bot. Freyc. Voy. Uranie 206. 1826–30.

Gaudichaud, in herb. Paris Mus.

An American and Asiatic species. Collected in Brazil, New Zealand, Java, and Malacca.

PERTUSARIA DC.

PERTUSARIA VELATA (Turn.) Nyl. in Hue, Rev. Bot. **5**: 118. 1886

Parmelia velata Turn. Trans. Linn. Soc. **9**: 143. *pl. 12, fig. 1.* 1808.

Lecanora pilulifera Pers. in Gaud. Bot. Freyc. Voy. Uranie 194. 1826–30.

Pertusaria pilulifera Nyl. Enum. Lich. 116. 1857.

Clausaria fallens Nyl. Ann. Sci. Nat. IV. Bot. **12**: 45. 1859.

Gaudichaud, in herb. Paris Mus.

First described by Turner from English material where he mentions that it is rarely found. Since collected in the tropics of America, Africa, Asia, and Oceania.

PARMELIA (Acharius) DeNot.

PARMELIA CAPERATA (Linn.) Ach. Meth. Lich. 216. 1803

Lichen caperatus Linn. Sp. Pl. 1147. 1753.

Gaudichaud, in herb. Paris Mus.

A species of very general distribution, both tropical and temperate localities forming its habitat.

RAMALINA Acharius

RAMALINA FARINACEA (Pers.) Nyl. Syn. Lich. **1**^{2}: 294. 1860

Physcia farinacea Pers. in Gaud. Bot. Freyc. Voy. Uranie 208. 1826–30.

Gaudichaud, in herb. Paris Mus.

Collected in tropical America, Tahiti, Japan, Malacca, India, and northern Africa.

RAMALINA SUBFRAXINEA Nyl. Bull. Soc. Linn. Norm. II. **4**: 139. 1870

Gaudichaud, in herb. Paris Mus.

Collected also in Chile, the islands of Juan Fernandez, and Mauritius.

PHYSCIA (Schreber) Wainio

PHYSCIA AIPOLIA (Ach.) Nyl. Flora **1870**: 38. 1870

Parmelia aipolia Ach. Syn. Lich. 215. 1814.

Physcia stellaris (Linn.) Fr. var. *aipolia* Nyl. Notis. Sällsk. Fauna Flora Fenn. **5**: 111. 1861.

Gaudichaud, in herb. Paris Mus.

Collected in Europe; the American and Asiatic tropics.

PHYSCIA CRISPA (Ach.) Nyl. Syn. Lich. **1**^{2}: 423. 1860

Parmelia crispa Ach. Syn. Lich. 312. 1814.

Physcia domingensis Nyl. Enum. Lich. 106. 1857.

Gaudichaud, in herb. Paris Mus.

A purely tropical species so far as known and collected only in the American tropics and the islands of the Pacific.

ANAPTYCHIA Koerber

ANAPTYCHIA DENDRITIC (Pers.) Wainio, Lich. Brésil 134. 1890

Borrera dendritica Pers. in Gaud. Bot. Freyc. Voy. Uranie 207. 1826–30.

Gaudichaud, in herb. Paris Mus.

This species as yet has only been reported from Brazil and the Marianne Islands.

RHIPIDONEMA Mattirolo

RHIPIDONEMA MEMBRANACEUM (Arg.) Sacc. Syll. Fung. **6**: 688. 1888

Dictyonema membranaceum Arg. Syst. Alg. 85. 1824.

Gaudichaud, in herb. Paris Mus.

Described from material collected in the Marianne Islands by Gaudichaud and placed under the Confervoideae. The species, however, belongs to the small group of the Hymenolichens which seem to be confined to a tropical habitat.

Found in the tropics of both the old and new world.

DOUBTFUL SPECIES

The following questionable species have been excluded from the list above. They are from Persoon's enumeration of Gaudi-

chaud's collection, twelve being types of new species. Further study will be necessary to establish their identity if that be possible.

Ctesium album Pers.
Ctesium rugosum Pers.
Gyrophora perforata Pers.
Collema ulvaceum Pers.
Collema peltigera Pers.
Collema stellare Pers.
Physcia fastigiata Pers.
Lycogala marianna Pers.
Sphaeria laguncula Pers.
Himantia nodulosa Pers.
Porinia tessellata Pers.
Ophegrapha cymbiformis Floerke
Ophegrapha cincta Pers.

NEW YORK BOTANICAL GARDEN.

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7. **Presl, C. B.** Reliquiae Haekeanae; seu Descriptiones et icones plantarum quas in America ——— in insulis Philippinis et Marianis collegit Thaddäeus Haenke **1**: 1–356. *pl. 1–48.* 1825–30. **2**: 1–152. *pl. 49–72.* 1831–35.
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NOTES RELATING TO THE GYMNOSPORANGIA ON MYRICA AND COMPTONIA

B. O. Dodge and J. F. Adams

(With Plates 2 and 3, Containing 9 Figures)

The only species of rust on the sweet fern heretofore reported is the *Cronartium* that has its *Peridermium* stage on the pines (Clinton, 1908; Orton & Adams, 1914). This rust was described by Arthur (1906) from material collected at Egg Harbor, New Jersey. It was quite abundant at Toms River, New Jersey, in September, 1915, where it was found by members of the party on the excursion conducted by the Torrey Botanical Club during the Twentieth Anniversary Celebration of the New York Botanical Garden.

During the spring and summer months of 1916, the writers, Professor Harper, and others made several trips into the pine barrens of New Jersey to gather data bearing on the life-histories of the species of *Peridermium* and *Gymnosporangium* to be found in this region. On June 14 we found that certain plants of *Comptonia* bearing *Cronartium Comptoniae* were also infected with some other rust whose spermogonial stage was just becoming evident. As no aecidium had been reported on this host, it was decided to make another visit to this spot a few weeks later to obtain mature specimens.

On July 4 we found a number of leaves and young shoots bearing ripe aecidia, and spores were being shed quite abundantly. The only leaves found to be infected June 14 were very young, some of them scarcely unfolded from the bud. The hypertrophy induced by the rust is not definitely limited, but is general and extends along either side of the midrib beneath, making the leaf quite thick and brittle.

As only a slight yellowish discoloration accompanies the infection, this stage of the rust is easily overlooked. We also found spermogonia on pistillate catkins, which were of a darker orange color. We were unable to find aecidia on these burs later.

The aecidia on the leaves and young stems appear to be scattered rather sparingly over the long hypertrophied or thickened portions. A marked transformation of the leaf seems to accompany infection. Every leaf that we found bearing aecidia had made a coil of one or two turns like a ram's horn, which, in a way, quite effectually conceals the rust from view. *Roestelia transformans* was originally described as causing considerable deformation of the *Aronia* leaves, yet a great many leaves infected are in no way misshapen. Further collections of this rust on *Comptonia* may prove that it does not always cause the leaf to roll up. The peridia are whitish, with very brittle segments which soon disappear, or break off and become scattered over the under surface of the leaf. The spores are globoid, varying in size from 25–35 μ. They appear to be rather dark-orange or salmon-colored in mass. The spore wall is finely warted or echinulate. This rust resembles *Aecidium myricatum,* known so far to occur only on the bayberries. *Cronartium Comptoniae* has been found also on species of *Myrica,* and it is not surprising to find that a *Gymnosporangium* capable of infecting *Myrica* could also infect *Comptonia* as the two genera are closely related.

Fromme (1914) has shown that *Aecidium myricatum* is connected with *Gymnosporangium Ellisii* on *Chamaecyparis.* In 1914 Dodge (1915) tried to infect *Comptonia* with *G. Ellisii* without success. The trial host plants lived only about two weeks after the inoculations were made, but as the rust appeared on the *Myrica* within a week it was presumed that this *Gymnosporangium* would not infect the sweet fern. The teleutospore material used at the time was in the best of condition, so that failure was not on this account. We made some attempts to infect the sweet fern with the spores of *G. Ellisii* under controlled conditions in the greenhouse, but the season was so far advanced that the sweet fern could not be made to survive transplanting, and the spores of *G. Ellisii* were past their prime.

Aecidium myricatum on the bayberry is especially abundant at Toms River; in places the rust appears to be destructive, especially where it attacks the branches or main stems. The southern white cedar and sweet fern grow together in many localities along the coast, but we have found the sweet fern rust only at this one

place, which is just across the bridge near "the bird-house establishment" at Toms River. Even here it is rare. If the rusts on the bayberry and sweet fern belong to the same species, it is interesting to note that the host reactions are somewhat different in the two cases.

The aecidia on the *Myrica* are ordinarily very closely crowded on rather definitely limited thickened areas (Pl. 2, f. 1–3). Infected sweet fern leaves are shown in Pl. 3, f. 1–4. The coiling of the leaves resembles somewhat the effect of insect work, especially such as one sees on sweet fern plants. The aecidiospores from the two hosts appear to be identical so far as size and wall characters are concerned. It is possible that they are darker colored in the rust on *Comptonia*. Our photographs (Pl. 2, f. 3, 4) show that the peridial segments may be more persistent and more recurved in the *Myrica* rust. This may have been due to the difference in the atmospheric conditions prevailing at the times the photographs were taken. Fromme (l. c.) found that spores of *Aecidium myricatum* had seven or eight germ pores. Professor C. R. Orton has kindly examined our specimens of the rust on *Comptonia* and *Myrica* and finds that the peridial cells and aecidiospores are the same in both forms, although the number of germ pores in the spores of the rust on the sweet fern was not determined.

We have made a number of inoculation experiments with *Aecidium myricatum* from *Myrica* with the view to determine the conditions under which the *Chamaecyparis* may become infected. Eleven potted cedars were sprayed with aecidiospores on June 21, 1915, and kept in a moist chamber two days. The plants were then stacked in the greenhouse under bayberry plants heavily infected with the rust. The cedars were sprayed twice each day during the time spores were being shed from the rusted bayberry plants. As yet there are no indications of infection. Reed and Crabill (1915) have raised the question in connection with the infection of red cedars by the apple rust whether it may not be that the aecidiospores winter over and infect the cedars in the spring. Just why this is assumed or thought possible is not clear in face of the fact that they show in tables of germination experiments that spores germinate in cultures to the extent of 12 per cent. in some cases during July.

We have shown that the percentage of germinating spores in our cultures of *Aecidium myricatum* is very low, yet one can find germinating spores in the drops of water on the leaves of cedars that have been sprayed and kept in the infection chamber twenty-four hours. The results of a number of test experiments are given in Table I. Tap water was used in all cases.

Table I. Shows the approximate percentages of germination of aecidiospores of *Gymnosporangium myricatum* in water cultures.

Date	Method	No. Tests	No. Positive Results	Approximate Percentage of Germination
May 22, 1915	Hanging drop	19	0	0
" 28, "	Petri dish	5	0	0
June 2, "	" "	12	0	0
Mar. 10, 1916	" "	6	0	0
June 10, "	Watch glass	2	1	.4%
" 11, "	" "	6	6	.3%
" 16, "	Petri dish	3	3	.5%
" 16, "	Watch glass	6	5	.2%
" 20, "	Hanging drop	6	0	0
" 20, "	Watch glass	6	6	.5%
" 20, "	Petri dish	3	3	1.0%
" 25, "	Watch glass	3	3	.5%

Where spores are floated on water in watch glasses or Petri dishes a low percentage of germination was obtained. In several cases in which watch glass tests of aecidiospores of both *G. myricatum* and *G. clavariaeforme* were made, the glasses were stacked on one another, and it was found that the spores in the uncovered dish germinated sooner and usually with a higher percentage. The Petri dishes were always set in the damp chamber, and without cover, so that there was an unlimited supply of air. Under these favorable conditions the spores begin to germinate within six or eight hours. Leaves bearing aecidia had been placed in cheesecloth bags and hung outside the greenhouse all winter; spores from these leaves did not germinate in Petri dish cultures when tried the following March, as shown in the above table.

In June, 1916, germination tests were made of aecidiospores of several other species of *Gymnosporangium*. There is the greatest variation in the behavior of the different species. *G. globosum* showed the lowest percentage, not over 0.1 per cent.; *G. juvenescens* up to 10 per cent.; *G. nidus-avis* occasionally as high as 50

per cent.; *G. clavariaeforme* invariably gave 95–100 per cent. germination if the watch glasses were left uncovered in the damp chamber.

The salmon color of the spores of *Aecidium myricatum* is due, as in many other spore forms, to the color of the spore contents.

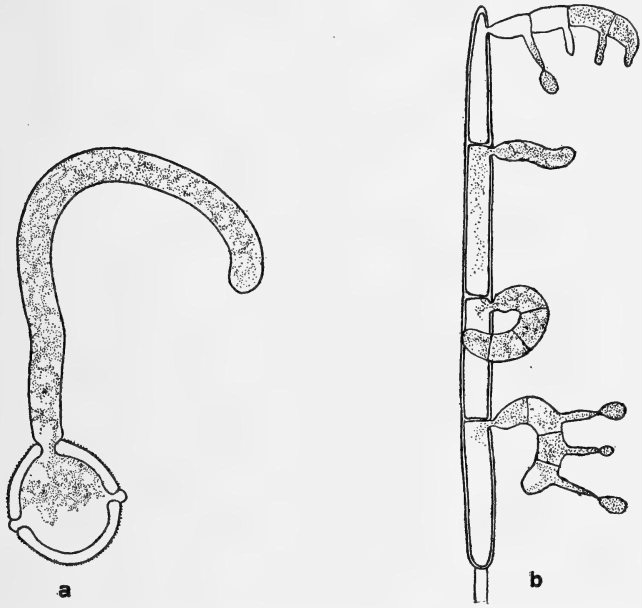

FIG. 1. *a.* Aecidiospore of *Gymnosporangium myricatum* twenty-two hours after the beginning of the germination test experiment. Three germ pores appear in one plane. Most of the orange-colored contents have moved out into the germ tube. × 450. *b.* A germinating teleutospore of *Gymnosporangium myricatum.* × 450.

The germ tube emerges from the germ pore and immediately enlarges considerably (Text-fig. 1, a); it sometimes branches rather irregularly. The wall of the spore is only slightly thickened about the germ pores. The brown color of the spores of the other species of *Gymnosporangium* mentioned above is in the spore wall, and there is, for example, in *G. clavariaeforme* a very prominent thickening of the wall about the spores. Sorauer's figure 50[9] (1906) of a germinating aecidiospore does not adequately bring out these features.

Reed and Crabill (1915) obtained much higher percentages of

germination of the aecidiospore of *G. macropus* than we have with *Aecidium myricatum,* yet they assume that the spores may winter over and germinate in the spring, since they were unable to obtain artificial infections of red cedars.

Harshberger (1902) has made a study of the behavior of the mycelium of *G. Ellisii* in the tissues of *Chamaecyparis.* He finds an abundance of intracellular hyphae in the cortex, soft bast, wood cambium and tracheids, as well as in the medullary rays, and believes that the mycelium residing in the wood cambium and soft bast is responsible for the increased thickening of the annular rings. Farlow (1880) has very adequately described this *Gymnosporangium* and figured very characteristically a small witches'-broom and a germinating teleutospore. Our figure 5 in plate 2 shows the sori in the dried conditions. We find that they do not swell up to such a great extent when moistened as do sori of most Gymnosporangia. The promycelia are usually quite sharply bent, as appears in Text-figure 1, b.

The perfection of methods by which seedling cedars may be easily infected should afford a better opportunity for studying the behavior of both the host and the fungus in their mutual relationships. The evidence is suggestive that *G. myricatum* also go to the sweet fern, but in view of the very complex interrelations which have so far been found between the hosts of the species of *Gymnosporangium* and their roesteliae, a positive conclusion can only be reached by actually demonstrating the infection of the sweet fern by *G. Ellisii.*

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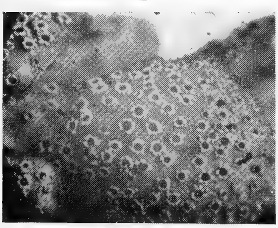

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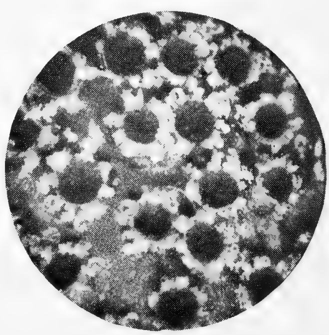

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5

GYMNOSPORANGIUM ELLISII—AECIDIUM MYRICATUM

1

2

3

4

RUST ON COMPTONIA ASPLENIFOLIA

Orton, C. R., & Adams, J. F. Notes on *Peridermium* from Pennsylvania. Phytopathology 4: 23–26. *pl. 3.* 11 Mr 1914.

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EXPLANATION OF PLATES

PLATE 2. GYMNOSPORANGIUM ELLISII—AECIDIUM MYRICATUM

Fig. 1. Leaf of *Myrica carolinensis* infected at one point showing crowded aecidia. Natural size.

Fig. 2. Portion of the same leaf. × 2¼.

Fig. 3. A group of aecidia from an infected bud. × 5.

Fig. 4. A number of aecidia showing the white, recurved, peridial segments. × 20.

Fig. 5. A small witches'-broom on *Chamaecyparis* showing numerous teleutospore sori in the dry condition. About natural size.

PLATE 3. RUST ON COMPTONIA ASPLENIFOLIA

Fig. 1. Twig and bud infected; aecidia just beginning to show. Natural size.

Fig. 2. Infected leaf coiled up; aecidia scattered sparingly on under side and along the branch which is also infected for some distance.

Fig. 3. Another leaf showing that the lobes and midrib portion are much thickened. Peridial segments broken away and lying about on the leaf surface. × 2.

Fig. 4. Portion of the same branch shown in Fig. 2. The white spots show where aecidia are forming. × 2.

NOTES ON A FEW SPECIES OF ASHEVILLE FUNGI

H. C. Beardslee

(With Plate 4, Containing 3 Figures)

The last instalment of *North American Flora,* vol. 9, part 5, has greatly interested me. The number of species of our fleshy fungi which are considered is very great and the amount of work which has been done will doubtless be of much value to all students of the fungi. Some of the conclusions reached would seem to admit of some argument, but time and discussion will doubtless settle the doubtful points.

At present I am interested in some of the species considered as doubtful. A few of these have seemed to me to occur in my collecting grounds.

Among these doubtful species, the one which was most of a shock is *Mycena stylobates.* A very interesting *Mycena* occurs at Asheville, which is doubtless the one on which the reports of *Mycena stylobates* have been based. It is very distinct, and has so many of the characters attributed to Quélét's species that I have always referred it there. *Plate 4, f. 1,* which accompanies these notes, shows its characters fairly well. As I have found it, the pileus was 4–6 mm. broad, pale-gray in color, thin and membranous, campanulate, becoming expanded, striate to the disk, and bearing a few scattered hairs, which are plainly visible under a lens; gills free or nearly so, ventricose, distant; stipe 2–5 cm. long, filiform and fragile, glabrous, seated on a flat disk which is marked with distinct striations and fringed with a row of bristles; spores $6 \times 3\,\mu$. The peculiar and striking feature is the base of the stipe. I have seen no other species which resembles it in this particular. In the figure, this feature can be distinctly seen. It will be seen that our plant answers the description very well except that the color as it occurs here is pale-gray and not white. Stevenson says of it, however, "commonly wholly white, but

varying gray, becoming azure-blue." Judging from this, the color would hardly be an insuperable barrier.

Our plant is at all events a very striking and distinct species and we should have some name for it. Personally, I shall prefer to call it *Mycena stylobates,* but at any rate it is too distinct and interesting to be excluded from our flora.

Mycena Iris Berk. seems also to occur here. I find at Asheville specimens which do not seem to differ from specimens of Berkeley's species which were found in Sweden. The group of forms which are to be found at Asheville with blue mycelium at the base of the stipe is very perplexing, and I have found my views as to the number of species which can be recognized changing. I find, however, a form, often growing on the ground which has seemed to me *M. Iris.* It is fairly large, 12–16 mm. and has the margin of the pileus clothed with curious blue fibrils, which are closely glued down to the surface of the pileus and give it a very distinct appearance. These fibrils seem to be largely lacking in the smaller forms which are found growing on logs, but are quite plain in the European plant. Whether we have more than one species in this group has seemed uncertain to me. In this connection it may be noted that Bresadola, early in Fungi Tridentini describes *Mycena calorhiza* with blue mycelium, but later on decides it to be a form of *Mycena Iris.* Evidently the same perplexing forms with blue mycelium occur in Europe.

Omphalia strombodes Berk. & Mont. is another species which seems to need attention. As it is described, it has the spores "subglobose 4–5 μ long." An European species has been described and figured by Bresadola as *Clitocybe xanthophylla,* afterward transferred to *Omphalia.* This agrees well with our plant in form, but is, as Bresadola writes me, distinct from the species described by Morgan in its spores. These he describes as subovate and pointed at one end, $7–8 \times 4–5\ \mu$. This would seem in these days ample difference for specific distinction.

The difficulty which I find in regard to the plant that occurs in North Carolina is that it agrees rather with Bresadola's description than with Morgan's. I have this summer examined about

a dozen collections, by setting the pilei on slides and measuring the abundant spores which were deposited. The prevailing form is exactly as Bresadola describes it in his plant, except that I find the spores a little larger than his limit. They are frequently 9 μ long, but are always ovate and pointed in the typical spores. There would seem, therefore, to be no valid reason, if the species are only distinguished by the spores, to consider our species distinct from *Omphalia xanthophylla*. The question is, however, whether we have two species in the United States or one. I have had no opportunity to examine fresh material from Ohio to ascertain whether the Ohio plant that Morgan found is different from the North Carolina plant. The fact that a small per cent. of spores are to be found in every deposit which are shorter and which could be reconciled with Morgan's measurements, makes me doubtful in regard to the distinction of the species. At all events, our plant would seem to be certainly Bresadola's species, and either the spore measurements given for *O. strombodes* should be modified or Bresadola's species should be added to our list of Omphalias.

Omphalia integrella (Pers.) Quél. appears almost every summer at Asheville. It is too small for a good photograph, but is so distinct that its identification is not difficult. As it occurs here, its distinguishing marks are the narrow and rather thick gills. I know of no other species which resembles it at all closely. I have felt very certain of its identity.

Omphalia gracillima Weinm. appears occasionally. In size and appearance it resembles Peck's *Marasmius albiceps*. It is, however, amply distinct from it. I find it pure-white, with a delicate, white stipe and the spores $6 \times 3\,\mu$. Bresadola has seen and approved my specimens. *Pl. 4, f. 2,* shows its appearance as well as can be expected in so minute a plant.

Omphalia cuspidata Quél. I have found a few times. *Pl. 4, f. 3,* shows its appearance well. It is pure-white and very small. Both the pileus and stipe are thicker than would be expected in so minute a species and the pileus has a strong umbo. The gills are narrow, distant, and usually forking. It is found in wet places on old leaves, and can easily be overlooked on account of

1. MYCENA STYLOBATES
2. OMPHALIA GRACILLIMA
3. OMPHALIA CUSPIDATA

its small size. My material and photograph were submitted to Bresadola and the determination approved by him. He said of it: "Identical in form and notes with *O. cuspidata* Quél. To me your plant is absolutely this species."

A number of other species seem worth discussing but this instalment will probably be sufficient at this time.

ASHEVILLE SCHOOL,
ASHEVILLE, NORTH CAROLINA.

EXPLANATION OF PLATE 4

Fig. 1. *Mycena stylobates.*
Fig. 2. *Omphalia gracillima.*
Fig. 3. *Omphalia cuspidata.*

SOME FUNGI COLLECTED IN VIRGINIA

William A. Murrill

During a brief vacation near the end of October, 1916, the writer spent several days on Apple Orchard Mountain in the Blue Ridge, eighteen miles north of Bedford, Virginia, and obtained a number of fungi for the Garden herbarium. Large collections of fungi had previously been obtained by me from the regions about Blacksburg and Mountain Lake, in the southwestern part of Virginia and from Falls Church, near Washington, but my knowledge of Blue Ridge fungi had been chiefly gained at Biltmore and the Pink Beds in western North Carolina.

October proved to be much too late for most of the fleshy species. The weather was no colder than in New York, but the season was earlier and most of these species had disappeared. *Hypholoma perplexum,* a late autumnal species, was the only one found in sufficient quantity to be used as food. *Laetiporus speciosus* had been common on oak and chestnut logs, but the sporophores were fast decaying. *Rostkovites granulatus* and *Russula rubrotincta?* were abundant in a pine grove south of Bedford at 1200 feet elevation, but were not seen in the mountains. This species of *Russula* was especially well-flavored, and entirely free from insects on account of the cool weather. *Trametes robiniophila,* a tough polypore, was common on black locust around Bedford, but did not occur in the mountains. It is a southern species.

Apple Orchard Mountain is 4200 feet high, about 200 feet higher than the famous twin Peaks of Otter, which are conspicuous a few miles to the west. There is a camp near the summit, where one may be very comfortable, and good mountain trails radiate from it in all directions. A large swamp near the camp is filled with *Rhododendron catawbiense* and *Kalmia latifolia* intermixed with old hemlocks, and many interesting fungi doubtless occur there in July and August. The chief forest trees are chestnut and species of oak, red oak predominating. The

chestnut canker has appeared in the valleys to the north and south of the mountain, but has not yet extended above them.

The summit of the mountain consists of masses of granite rock, with some grass, a few stunted red oaks, the Alleghany birch, and thickets of hawthorn, willow, dogwood, gooseberry, and hazelnut. The north side of the mountain, especially near the waterfall and brook, is quite moist and should yield a large number of fungi at the proper season.

In the following list of fungi, which is alphabetical, the numerals 1–3 denote a definite number of times collected, while the letters *n, nn,* and *nnn* mean "frequent," "common," and "very common," respectively.

List of Species Collected

Armillaria putrida[2]
Bjerkandera Spraguei[1]
Bovista pila[n]. In open field.
Calostoma lutescens[n]. Abundant by roadsides in rhododendron thicket. Dr. Plukenet described this as "Fungus pulverulentus, virginianus, caudice corallino, topiario arte contorto."
Clitocybe sp.[1] In open grassy field. Neither *C. dealbata* nor *C. aperta.*
Claudopus nidulans[1]
Coltricia cinnamomea[1]. In sandy soil.
Coriolus nigromarginatus[n]
Coriolus prolificans[nnn]
Coriolus versicolor[nn]
Corticium polyporoideum[1]. On oak bark. Determined by Professor E. A. Burt.
Crucibulum vulgare[1]
Daedalea confragosa[n]
Daedalea quercina[n]
Daldinia concentrica[n]
Elfvingia megaloma[n]
Exobasidium Vaccinii[1]
Flammula sp.[1] On a dead oak log.
Flammula sp.[1] On a dead stump of *Kalmia latifolia.*
Fulvifomes Robiniae[n]
Gymnopus dryophilus[1]. On a deciduous stump.
Gymnosporangium sp.[1] On fruits of *Crataegus neofluvialis.*
Gyrophora Muhlenbergii[nn]. On rocks along summit of mountain. "Black Rock" owes its name to this lichen.
Hapalopilus gilvus[n]
Hemiarcyria rubiformis[1]. Abundant on a dead trunk. This is a beautiful little slime-mold.
Hexagona alveolaris[1]

Hydnoporia fuscescens[1]
Hydnum sp.[1] On leaf-mold in woods.
Hydnum adustum[2]
Hydnum caput-ursi[1]. On a standing oak trunk on summit.
Hypholoma perplexum[nn]
Inonotus radiatus[1]. On dead *Betula alleghanensis* on the summit.
Ischnoderma fuliginosum[1]. On hemlock.
Laccaria laccata[n]
Lachnocladium sp.[1]
Laetiporus speciosus[nn]
Lentinus strigosus[1]
Lenzites betulina[1]
Lycogala epidendrum[1]. A common slime-mold, not properly included among the fungi.
Lycoperdon gemmatum[1]. In sheltered woods.
Monadelphus illudens[1]
Panellus ursinus[1]
Plowrightia morbosa[1]. On *Prunus serotina*.
Poria sp.[1] Yellow.
Poria sp.[1] With hymenium somewhat resembling that of *Coriolus biformis*.
Poria medullapanis[1]. On black locust.
Prunulus galericulatus[n]
Pyropolyporus igniarius[1]. On birch.
Schizophyllus alneus[n]
Scleroderma aurantiacum[1]
Scleroderma Geaster[1]. On a sheltered southern slope.
Spongipellis fragilis[1]. Abundant on a decayed hemlock log. I had collected this rare species at Ohio Pyle, Pa., and Lake Placid, N. Y., but not in Virginia. See "Southern Polypores," p. 61.
Stereum candidum[n]. On living white oak trunks, apparently confined to the bark.
Stereum complicatum[2]
Stereum lobatum[nn]
Stereum rugosum[1]. On a birch trunk.
Tremella lutescens[1]. On a hemlock log.
Tyromyces chioneus[3]

NEW YORK BOTANICAL GARDEN

NOTES AND BRIEF ARTICLES

Dr. V. H. Young, formerly of the Botanical Department of the University of Wisconsin, has been appointed professor of botany in the State University of Iowa, in charge of mycology and plant physiology.

Dr. Alban Stewart, instructor in botany at the University of Wisconsin, has been appointed professor of botany and bacteriology in the Florida State College for Women at Tallahassee, Florida.

Dr. J. C. Arthur and Professor H. S. Jackson, of Lafayette, Indiana, have been granted research scholarships for the month of January. They will continue work on the plant rusts for *North American Flora.*

Newton B. Pierce, formerly plant pathologist for the U. S. government for the Pacific coast region, died at his home in California on October 13, aged sixty years.

Professor J. C. Arthur recently received the degree of Doctor of Laws from the University of Iowa. In conferring the degree, Professor Macbride placed special emphasis on Professor Arthur's contributions to agriculture and horticulture in the study of plant diseases; his work in physiological botany; and his fundamental studies in mycology, especially in the plant rusts. Professor Arthur has the distinction of being the first botanist appointed to an American experiment station.

Helicostylum and *Cunninghamella,* two genera of the Mucorales new to America, were reported from Michigan by A. H. W. Povah in the seventeenth annual report of the Michigan Academy of Science.

"The Comparative Histology of Certain Californian Boletaceae," by Dr. H. S. Yates, is a recent publication of decided merit from the department of botany of the University of California. There is opportunity for this harmonious blending of morphology and taxonomy in most groups of fungi.

The report of the Selby Smelter Commission recently issued as Bulletin 98 of the Bureau of Mines at Washington contains valuable information regarding the effect of smelter gases on various forms of vegetation, including fungi. The last twenty pages of the report are devoted to a bibliography on the injurious effects of sulfur dioxid.

The list of unreported Michigan fungi for 1911–1914, by C. H. Kauffman, covers about twenty pages in the seventeenth annual report of the Michigan Academy of Science, half of which are devoted to rusts. The example set and so patiently followed by Dr. Kauffman is highly commendable and worthy of imitation by mycologists in every state.

The great quantity of *Coprinus comatus* which often springs up in newly made streets and roads suggests that some method might be devised for cultivating this attractive and well-flavored edible species; which could not be shipped nor exposed long in the market, but would be valuable if grown in one's garden. This is an experimental problem suitable for almost any careful and patient student.

A recent bulletin by John R. Johnston on the present status of the cocoanut budrot disease states that the export of cocoanuts from Baracoa, Cuba, in 1898 was 24,000,000 nuts and in 1915 only 4,000,000. In Jamaica, a law was passed in 1911 to prevent the spread of infectious diseases, with the result that the budrot disease has caused little damage there since. The disease has not yet reached Florida, the Bahamas, Porto Rico, Panama or Mexico.

Dr. S. M. Stocker, of Duluth, Minnesota, recently sent in specimens of *Lentinus strigosus,* which in the fresh state had an odor

resembling that of slippery elm. Dr. Stocker not only tested the specimens himself, but submitted them to two drugs clerks independently and both of them promptly agreed with him. Dr. Stocker calls attention to the fact that Massee says that the odor of this species is spicy and W. Smith states that it smells pleasantly of anise.

Romell, in a recent number of the *Svensk Botanisk Tidskrift,* explains the brown powder occurring on the upper surface of hymenophores of *Ganoderma lucidum* and *Elfvingia applanata* as true spores from the basidia wafted upward by currents of air and allowed to settle on the hymenophores and nearby objects, where they adhere by means of their gelatinous coats. This would upset the conidia theory. The air currents are explained by Romell as follows:

"It is perhaps not unreasonable to suppose that from the ground heated during a hot day arise during a following cold and calm night upwardly directed air currents, which though very feeble and perhaps not perceptible to our senses, yet are strong enough to force the falling spores upwards, so that these are caused to hover in the air above their native place a more or less long while ere they are allowed to fall again and land on the upper side of objects lying in their way."

A splendid specimen of *Inonotus dryophilus* was obtained on December 4, 1916, from the trunk of a living white oak which stands in the Hemlock Forest near the Waterfall. It grew about 25 feet from the base of the tree and emerged from a small knot-hole. In the autumn of 1908, a smaller, more resupinate specimen was taken from near the base of the same tree and reproduced in color in *Mycologia* for May, 1909. During the intervening years, a few very small hymenophores have appeared at various times at different knot-holes on the trunk, but so far as known the tree has never produced a specimen of such proportions as the one just collected. The trunk of the tree must be badly decayed by this time, and many of the lower branches have disappeared.

A new disease of *Paulownia tomentosa,* caused by *Valsa Paulowniae,* is described by Takewo Hemmi in a recent number of *The Botanical Magazine* of Tokio, Japan. This disease attacks the branches and trunks of *Paulownia tomentosa* without regard to its age, but the young trees three or four years old are most liable to attack. In the case of a young tree, the disease appears first at the tip of the clear trunk in the early spring. The bark of the affected part turns brown in color, as if killed by freezing. The discolored portion gradually increases its area, extending downward toward the thicker portion of the stem. From May to June, the disease progresses most rapidly, and in consequence the tree is killed, with an appearance of "die-back." The fungus enters the tree through a wound having a layer of dead cells on its exposed surface, in which a mass of mycelium is first formed. In the vicinity of Sapporo, the winter injury due to the very low temperature is the most common and powerful agency in inducing the spread of this disease.

NEW COMBINATIONS

Most of the new species published in *North American Flora,* volume 9, part 6, belong to the genus *Clitocybe,* which is commonly accepted by mycologists. For others, the following new combinations are here proposed:

HYDROCYBE CALIFORNICA = **Hygrophorus californicus**
CAMAROPHYLLUS ANGUSTIFOLIUS = **Hygrophorus angustifolius**
CAMAROPHYLLUS AURATOCEPHALUS = **Hygrophorus auratocephalus**

The only species published in *Mycologia* last year that need be recombined is the following, described on p. 113:

MELANOLEUCA OLIVACEIFLAVA = **Tricholoma olivaceiflavum**

Species published in *Mycologia* for 1915, on pp. 44 and 222, may be recombined as follows:

ROSTKOVITES CACLIFORNICUS = **Boletus californicus**
GYMNOPILUS FARINACEUS = **Flammula farinacea**

W. A. MURRILL.

TWO NEW SPECIES OF FLESHY FUNGI

Gymnopus Ellisii Murrill, sp. nov.

Pileus minute, convex, becoming depressed, gregarious, 2 mm. broad; surface milk-white, dry, minutely pubescent, margin at

first incurved; lamellae adnate, becoming slightly decurrent, narrow, not crowded, white; stipe slender, hollow, pulverulent, white, pubescent at the apex, mycelioid at the base, 1–1.5 cm. long, less than 1 mm. thick.

Type collected on leaves and twigs of white cedar in a swamp at Newfield, New Jersey, October, 1875, *J. B. Ellis* (herb. N. Y. Bot. Gard.).

DISTRIBUTION: Known only from the type locality.

Omphalopsis pallida Murrill, sp. nov.

Pileus conic to convex, becoming umbilicate, gregarious, 1.5 cm. broad; surface dry, smooth, minutely silky, not striate, pallid, pale-avellaneous on the disk; lamellae decurrent, especially when young, arcuate, distant, broad, white; spores ellipsoid, smooth, hyaline, $7\text{–}8.5 \times 4\text{–}5\,\mu$; stipe very slender, cartilaginous, equal, smooth, hyaline, white, 2–3 cm. long, 1 mm. thick.

Type collected in soil on a roadside bank at Lake Placid, Adirondack Mountains, New York, October 3–14, 1912, *W. A. & Edna L. Murrill 1093* (herb. N. Y. Bot. Gard.).

DISTRIBUTION: Known only from the type locality.

For the benefit of those using Saccardo's nomenclature, the following new combinations are proposed:

GYMNOPUS ELLISII = **Collybia Ellisii**
OMPHALOPSIS PALLIDA = **Omphalia pallida**

W. A. MURRILL.

AN EPIDEMIC OF RUST ON MINT

During the summer of 1915, an epidemic of rust (*Puccinia Menthae* Pers.) developed in gardens at Hanover, New Hampshire. The disease was first discovered about the middle of June, or about two weeks after the beginning of a long period of heavy and almost continuous rainfall. The chocolate-brown sori broke out on the leaves of the mint and increased with such rapidity that by the early part of August the plants were rendered unfit for table use.

Since this is the first attack of the disease in this locality, at least so far as the writer can determine, and since the rainfall was far above that of a normal season, it became a matter of interest

to determine whether or not the rust would reappear. For this reason the infected growth was left undisturbed in the fall, and no attempt was made to control the disease.

Throughout the present summer the mint beds have been carefully watched but no trace of the rust has been found at any time.

These observations, though somewhat superficial, would seem to indicate that this rust, which is capable of destroying the foliage of the mint plant during a wet season, may become entirely inactive with the return of a normal season.

A. H. CHIVERS.

SOME PAPERS PRESENTED DURING CONVOCATION WEEK

At a joint session of the Botanical Society and the Phytopathological Society held Friday afternoon, December 28, in connection with the American Association for the Advancement of Science, a number of papers were delivered which were of interest to mycologists.

The first paper of the afternoon was presented by Dr. J. C. Arthur, of Purdue University. After briefly outlining the results of his work on the rust cultures for the season, he gave a very interesting retrospect of his work on rust cultures beginning in 1899. Previous to this time, it had been pretty generally agreed that each rust had a definite life cycle consisting of several stages often borne on different host plants, but the life histories of few species were well known.

About this time a visit was made to Charles B. Plowright of England and his methods of culturing rusts studied carefully. These methods were very simple and consisted in sprinkling a barberry bush with water from an ordinary sprinkling can. The teliospores were then removed from some grass and placed on the leaves of the barberry. The plant was again sprinkled and placed under a belljar, where it was allowed to remain for several days. The belljar was then removed and in due time the rust infection appeared.

On returning to America these methods were employed with some modifications in working out the life histories of various species of rusts. The work has been continued up to the present time and the results published at intervals in various scientific

journals. Some time was also spent in outlining the changes in our ideas of what constitutes a species in the rusts. The differences of opinion regarding physiological and morphological species were considered.

Following this paper, I. E. Melhus called attention to his observations on the development of aecia on red clover in the greenhouse. Although several other clovers grew in close proximity, they remained entirely free from infection. Attempts to inoculate other clovers with the aecia from red clover were unsuccessful.

In the absence of G. R. Bisby, Dr. Arthur outlined briefly the contents of his paper, dealing with the rusts on the Onagraceae. Several species have formerly been recognized which have slight morphological variations. These apparent differences, however, become less conspicuous as the number of specimens increase. Mr. Bisby has concluded that these supposed species represent one very variable species in which several races or strains can be separated with very slight morphological variations.

A paper by W. H. Davis and A. G. Johnson on the aecial stage of the red clover rust was presented by Mr. Johnson. Examination of red clover from a number of fields showed aecia to be present in all except one. A request was then sent out for red clover plants from various localities. Over half of them showed aecia. Teliospores were used to make sowings and from these aecia were again obtained, showing the rust to be autoecious.

In the absence of E. B. Mains, Dr. Arthur also outlined his paper. Until recently, no species of *Melampsora* has been known in the Western Hemisphere on *Euphorbia*. In one year three such species have been reported, occurring from Maine to Wyoming. One of these was doubtless imported, while the one occurring in Indiana was probably native but identical with a European species. This sudden occurrence of a class of rusts formerly unknown in America in such widely separated localities is regarded as rather a remarkable phenomenon.

Dr. Arthur, in the absence of Mr. Bisby, also mentioned his paper on the short-cycled species of *Uromyces* in North America. Also, in the absence of C. A. Ludwig and C. C. Rees, the same speaker made a brief mention of their work on the structure of the uredinium in *Pucciniastrum Agrimoniae*.

The next paper was by John A. Elliott on a new parasitic slime-mold suitable for class work. This slime-mold causes a very serious disease of sweet potatoes. There are two methods of infection, one by means of swarm spores and one by means of the plasmodium. Spots are caused by the plasmodium entering the young rootlets. The plasmodium finally migrates from the wounds, leaving pits. The paper was well illustrated by lantern slides. Considerable discussion followed.

Dr. Arthur again covered the main points in Mr. Rees's paper on the *Fritillaria* rusts of Europe and America. From his studies it was concluded that there were two species of rusts on *Lillium* and *Fritillaria* hosts and that the American species were different from the European.

R. H. Colley spoke of the difficulty of diagnosing the white-pine blister disease before the spores are developed. It has been found by him that the pycnial scars are very characteristic and with experience can be used in detecting the presence of the disease. A number of slides were shown, illustrating the pycnial scars and also the rusty color of the mature spores.

The Uredinales of the West Indies were next treated by Dr. Arthur. This study was taken up a year ago in connection with extensive collections of F. L. Stevens, who for some time past has been making a study of the parasitic fungi of Porto Rico. In addition to these, Drs. Olive and Whetzel collected a number of species not previously known. Other collectors have added to the list, including Mr. Percy Wilson and other collectors from the New York Botanical Garden. The total number of species known from the West Indies is 214. It has been found that, so far as the rust flora is concerned, the Cuban flora resembles that of North America while the Porto Rican flora resembles that of South America. One noteworthy fact in connection with the West Indian rusts is the large number of short-cycled species. It has been preciously supposed that short-cycled rusts were an adaptation to a short growing season. Under tropical conditions, twenty-five per cent. of the species are found to be short-cycled, a fact which is directly contrary to previously accepted theories.

Dr. Trelease presented the paper on the parasites of *Meliola* in Porto Rico which was to have been read by Dr. F. L. Stevens.

A number of fungi associated with *Meliola* which were previously supposed to represent a stage in the development of the *Meliola* are now known to be parasites. A list of about thirty such species has been prepared for publication, belonging mainly to the ascomycetes and imperfects.

G. W. Keitt next read a paper on the leaf spot of cherries. Cherries are cultivated extensively in the region studied and the leaf spot has been very destructive. The paper was limited mainly to the methods of controlling the disease. Control has been accomplished along two lines: (1) sanitation and (2) spraying. Both together have been found to be very effective. Several different kinds of sprays have been employed. The effectiveness of the control was well illustrated by means of lantern slides.

W. C. Coker spoke on the genus *Amanita* in the South. The material on which this paper was based was collected in the same general region in which Curtis and Ravenel collected many years ago. According to Coker, there is no good reason for separating the two genera *Amanita* and *Amanitopsis*. Specimens found growing in large numbers in close proximity showed the presence of the veil to be very inconstant. In many cases, it simply failed to develop. Interesting discussion followed the reading of this paper.

The next paper was by J. Rosenbaum on strains of *Rhizoctonia*. Two strains of this fungus have been isolated from the stems of potatoes, which can be distinguished pathologically, physiologically, and morphologically. It is possible that the presence of different strains may account for the conflicting reports regarding artificial infection by the fungus.

C. W. Edgerton spoke briefly of disease resistance to certain fungi in tomatoes. There is a great deal of difference in the susceptibility of plants grown in the same field. Selection and crossing of plants have shown good results in the production of immunity to the disease. Discussion followed the reading of the paper.

R. H. Colley gave a very interesting paper on the mycelium of the white-pine blister rust, calling attention to the way in which the haustoria penetrate practically every cell in the infected region of the host, often causing the nucleus to be pushed in on one

side. The paper was well illustrated by lantern slides showing the microscopic details.

Owing to the lateness of the hour, the writer failed to hear the reading of the last two or three papers. The meeting was well attended and considerable interest was manifested in the subjects under discussion.

At the Saturday morning session of the Phytopathologists, in addition to the strictly pathological papers, several papers were offered which were of interest mycologically.

One paper which deserves special mention was that by L. H. Pennington on Boleti and mycorrhiza upon forest trees with special reference to those of white oak. It was suggested that some of the mycorrhiza might be strictly parasites rather than mutualistically associated with the host. Attention was also called to the observation of certain sclerotia which appeared to belong to the Boleti and it was thought that possibly the Boleti wintered over in this form. In the discussion that followed, Professor R. A. Harper mentioned the finding of numerous sclerotia in Wisconsin in oak clearings.

F. D. Fromme called attention to root rot of apples caused by species of *Xylaria*. While this fact has been frequently observed, it is almost new to literature. The symptoms and amount of loss were considered and illustrated by a number of lantern slides.

Dr. Arthur read parts of a paper on a key to the aecia of the *Carex* rusts prepared by F. D. Kern which would enable the botanist to identify these rusts by the aecial stage. It was referred to as a clever scheme and the first key of its kind ever undertaken.

E. W. Olive called attention to a rare rust from Porto Rico. This has been classed as an insect gall by local botanists and in fact somewhat resembles one. While it shows certain rust characters, its position with this group is a little uncertain. In the discussion that followed, Professor R. A. Harper suggested that it might be an intermediate form between the smuts and the rusts.

FRED J. SEAVER.

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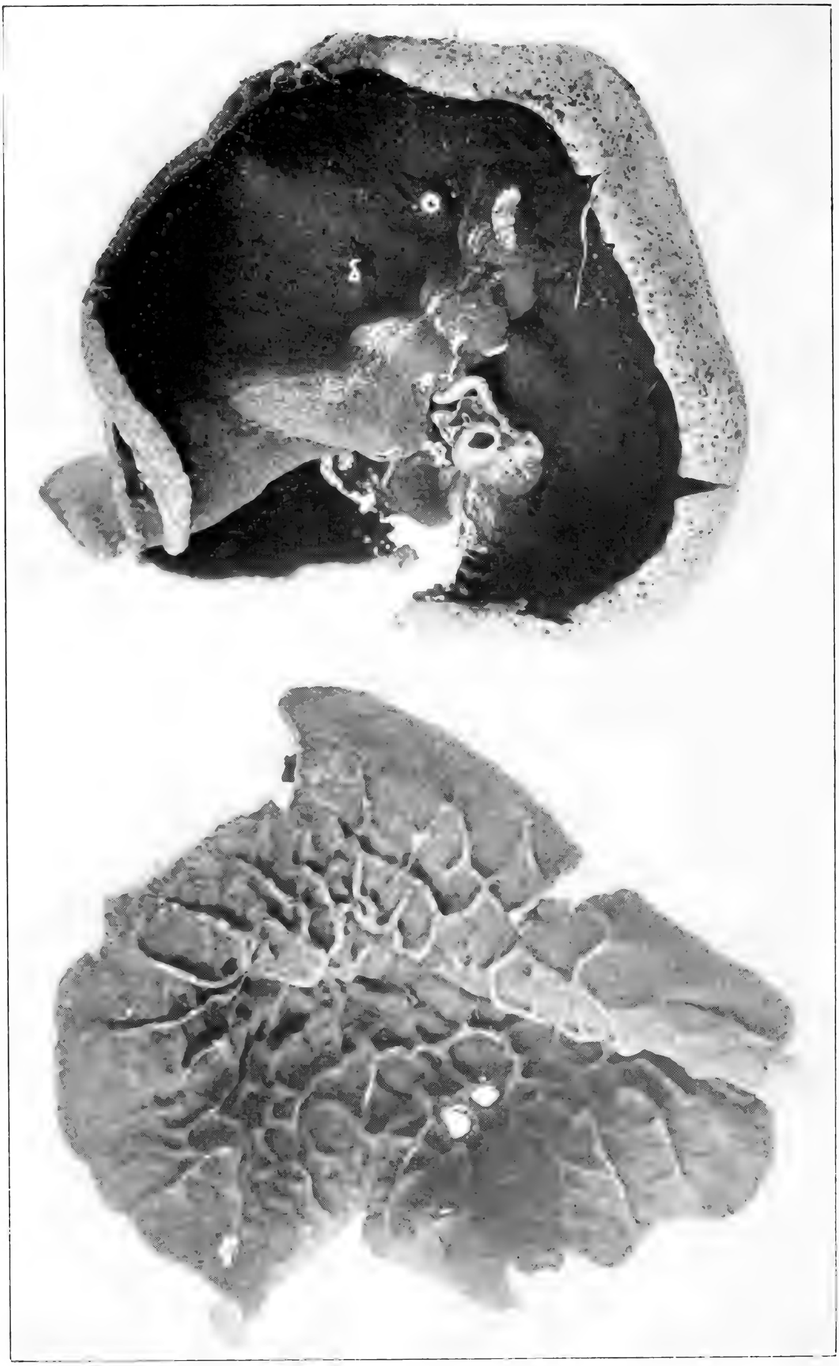

DISCINA VENOSA (PERS.) SACC.

MYCOLOGIA

VOL. IX MARCH, 1917 No. 2

PHOTOGRAPHS AND DESCRIPTIONS OF CUP-FUNGI—V. DISCINA VENOSA

FRED J. SEAVER

(WITH PLATE 5)

During the past two seasons, a number of specimens of *Discina venosa*, one of the largest and most attractive species of the cup-fungi, have been referred to the writer for determination.

As shown in the accompanying photograph and as indicated by the specific name, the hymenium shows a strong tendency to become folded into vein-like markings. While these are sometimes absent in young specimens, they are almost invariably present in matured forms to a greater or lesser extent. This characteristic has suggested such names as "*venosa*" and "*reticulata*" both of which have been used by different authors as a specific name for the same species.

In the herbarium of the New York Botanical Garden are a number of specimens of this species collected at Farmington, New York, by Edgar Brown in May and June, 1890. The largest specimen in this collection was said to measure twelve inches in diameter, while many of them were five to seven inches. These plants were erroneously referred by Mr. Ellis to *Peziza perlata* Fries, a species which closely resembles *Peziza venosa* in external appearance, although usually not so large. A part of the same material was apparently distributed in North American Fungi *2621* under this name.

The specimens from which the accompanying illustrations were produced were collected by Dr. L. H. Pennington near Syracuse,

New York, in May, 1916. Similar specimens were sent by Dr. Pennington in May, 1915, and his letter indicates that the species had been observed the preceding year. The collection of the same species in the same general region three times either in May or June is an interesting coincidence and probably indicates about the time the species should be expected in that latitude.

DISCINA VENOSA (Pers.) Sacc. Syll. Fung. **8**: 104. 1889

Peziza venosa Pers. Syn. Fung. 638. 1801. (Excl. syn.)
Peziza reticulata Grev. Scot. Crypt. Fl. 156. 1825.
Plicaria reticulata Fuckel, Symb. Myc. 328. 1869.
Aleuria venosa Gill. Champ. Fr. Discom. 37. 1879.
Acetabula venosa Lamb. Fl. Myc. Belg. *2*: 574. 1880.
Discina reticulata Sacc. Syll. Fung. **8**: 100. 1889.
Disciotis venosa Boud. Hist. Cl. Discom. Eu. 42. 1907.

Apothecia solitary or gregarious, substipitate with the base lacunose, at first shallow cup-shaped, soon becoming depressed and finally resting on the substratum with the extreme margin slightly elevated, when young entire, often irregularly radially splitting at maturity, externally whitish or brownish white, and slightly pruinose or scurfy, reaching a diameter of 20 cm.; hymenium reddish-brown, dried specimens often dusted over with the spores which are rust-colored in mass, and with the hymenium irregularly convolute, convolutions either radial or giving a reticulate character; asci cylindric or subclavate, reaching a diameter of 25 μ; spores 1-seriate or slightly crowded, ellipsoid, smooth, pale yellowish, $22–30 \times 12–17\ \mu$; paraphyses clinging together in masses, enlarged above reaching a diameter of 8 μ, yellowish-brown.

On the ground in deciduous woods.

TYPE LOCALITY: Europe.

DISTRIBUTION: New York to Ohio; also in Europe.

ILLUSTRATIONS: Boud. Ic. Myc. *pl. 254;* Gill. Champ. Fr. Discom. *pl. 34;* Grev. Scot. Crypt. Fl. *pl. 156;* Rab. Krypt. Fl. 1^3: 922, *f. 1–3.*

EXSICCATI: Ellis & Ev. N. Am. Fungi *2621.*

NEW YORK BOTANICAL GARDEN.

UREDINALES OF PORTO RICO BASED ON COLLECTIONS BY H. H. WHETZEL AND E. W. OLIVE

J. C. Arthur

A botanical expedition was made to Porto Rico in the spring of 1916 by Professor H. H. Whetzel, of Cornell University, and Dr. E. W. Olive, of the Brooklyn Botanic Garden. They reached the island on February 23, and left it on April 26, permitting thus about two months of uninterrupted work. All kinds of plants were collected, but especial attention was given to fungi, and a generous portion to the Uredinales. As a result of their labors 383 numbered collections of Uredinales were secured and shortly afterward submitted to the writer for study. The 383 collections were found to represent 122 species, as now understood, and these are systematically treated in the following pages. The writer and the scientific public are under large obligation to the collectors for their assiduous and painstaking labors, and for their generosity in turning over to another the whole set for unreserved examination and record.

A unique and most fruitful part of the work of the collectors was a careful and adequate test of the mode of germination of all so-called species of *Aecidium,* made at the time they were found. The new methods of testing the behavior of spores on solid substrata or on water surfaces were used. From the results it was learned that four forms, heretofore considered aecia and supposed to belong to heteroecious species, and another similar form but unrecorded for the island, were in reality aecidioid telia representing short cycle species, while five other similar forms were undoubtedly to be considered heteroecious aecia. The full morphological and incidentally taxonomic study pertaining to this part of the subject has been published by the collectors (Am. Jour. Bot. 4: 44. 1917).

In connection with observations on the aecia-like species care-

ful search was made in the field for clues that might lead to the discovery of alternate forms for the true aecia. In two cases most promising indications were detected. *Aecidium passifloriicola* was found a number of times so intimately and exclusively associated with *Puccinia Scleriae* that little doubt seems to remain regarding their genetic connection. Living host plants for both rusts were sent to Lafayette, Indiana, and apparently good telial material for cultures, but the teliospores could not be made to germinate, and no cultures were secured. *A. tubulosum* was also taken intimately associated with *Puccinia substriata,* but this connection also needs confirmation by cultures. It is a curious situation that with only five or six true unattached aecia that may be considered heteroecious, there are some twice as many species of grass and sedge rusts on the island, which produce telia in sufficient abundance to indicate that they may occasionally complete their life cycle with aecia. Most of the grass and sedge rusts of Porto Rico, however, evidently reproduce in that region only by uredinia.

It is interesting to note increased results obtained by systematic efforts in collecting a certain class of plants. If we compare the collections obtained by Clinton (1904), Holway (1911), Stevens (1913 and 1915), and Whetzel-Olive (1916), all by well-informed uredinologists and excellent observers, it will be noted first that the two later sets contain about five times as many species as the two earlier sets. This is accounted for in part by the length of time employed. But the two earlier collectors evidently did not see many rusts in the field to collect, while Stevens required nearly two years to secure as many species as Whetzel-Olive obtained in about two months. All these collectors came to the island without direct knowledge of tropical vegetation, and did not know the plants by name. Thus the published list of the Stevens collection, which Whetzel and Olive had in their possession, did not help much at the time, because for the most part they were not able to recognize the plants at sight to which the names applied. It is highly probable that the difference in results can largely be accounted for by a gradual, and quite likely, unconscious recognition of a marked difference between the macroscopic appearance of the majority of tropical rusts and those of

temperate regions. The generally applanate or pulvinate, strongly colored sori of most rusts of northern regions, render them far more conspicuous than the protected, pale sori, sunken in the tissues or surrounded by paraphyses, more common in the tropics. A growing recognition of this difference led more and more to a search for the inconspicuous, so-called *Uredo*-forms on plants of pronounced tropical appearance. In this way each of the two later sets presented a long list of forms that at first could only be classed under the form-genus *Uredo*. In the Stevens list were 37 such forms, which by careful microscopic study were assorted into 18 forms that could be labelled with published names, 14 that needed to be described as new, and 5 with which other spore forms could be found which permitted them to be placed under true genera. In the Whetzel-Olive list are 31 such forms (exclusive of 3 reduced to synonymy in the Stevens list), which have been assorted into 22 previously known, 4 new, and 5 placed under permanent genera. These figures do not include new or old species where the collections showed little or no other form beside uredinia, but which are generally and readily referred to true genera, such as *Uromyces appendiculatus, Puccinia Leonotidis,* and the species of *Coleosporium.*

Although the Whetzel-Olive set contains the same number of species as the Stevens set, allowing for the reduction of some species to synonymy, yet they are not wholly duplicates, as each shows 27 species not found in the other. The Whetzel-Olive material has added 25 species to the recorded rust flora of Porto Rico, 11 of which are new to science, beside permitting the erection of 3 new genera, the arranging of 10 new combinations and bringing to light of many new hosts for previously known species. There are 157 species of Uredinales now reported for Porto Rico, exclusive of *Hemileia vastatrix* B. & Br., the Asiatic coffee rust, which is dropped from the list because it is believed to be exterminated from the island.

The Whetzel-Olive set provided additional spore-forms which permitted the removal of *Uredo concors, U. capituliformis* and *U. fallaciosa* from the form-genus *Uredo* to their proper generic positions, and in so far assisted in the slow process of classifying the host of tropical rusts ordinarily found only in the repeat-

ing spore stage. Some advance was made in the case of another form, *Uredo Plucheae,* by the discovery of aecia associated with the uredinia, but telia must be found before the true generic position is assured. Material was also provided, which permitted the assignment of two *Uredo*-forms to a genus of striking and highly distinctive characteristics. This new genus is dedicated to one of the collectors in recognition of his important contributions to the fundamental understanding of the evolution of the Uredinales, and also as a tribute to the notable success of the expedition.

As the present paper may be considered in a way a continuation of the Porto Rican rust flora, as begun in the report on the Stevens collections (MYCOL. **7**: 168–196, *227–255*, 315–332; **8**: 16–33. 1915–16), the same form of treatment has been used as in that paper, but with omission of both citation and synonymy for both the rusts and hosts appearing in that list. For species not occurring in the Stevens list, however, citations and synonymy are given. When a species is listed here under a different name than in the Stevens list, it is followed by the previously used name in parenthesis without citation.

Family: **Coleosporiaceae**

1. COLEOSPORIUM ELEPHANTOPIDIS (Schw.) Thüm.

ON CARDUACEAE:

Elephantopus mollis H. B. K., Mayagüez, Feb. 29–Mar. 6, II, *151*.[1]

2. COLEOSPORIUM IPOMOEAE (Schw.) Burr.

ON CONVOLVULACEAE:

Ipomoea angustifolia Jacq., Campo Allegra, April 21, II, *306*.

Ipomoea Batatis (L.) Lam., Barceloneta, April 6, II, *304;* El Yunque, April 14, II, *303, 305*.

Ipomoea rubra (Vahl) Millsp., Rio Piedras, April 11, II, iii, *309;* El Yunque, April 14, II, *308*.

Ipomoea stolonifer (Cyrill) Poir., Santurce, April 24, II, *307*.

[1] All numbers of the Whetzel-Olive set are collections made in the year 1916.

Jacquemontia tamnifolia (L.) Griseb., Añasco, March 28, II, *242*.

3. COLEOSPORIUM PLUMIERAE Pat.
ON APOCYNACEAE:
Plumiera alba L., Guanica, March 30, II, *299*.

Family: **Uredinaceae (Melampsoraceae)**

4. PHYSOPELLA VITIS (Thüm.) Arth.
ON VITACEAE:
Vitis vinifera L., Maricao, March 22, II, *347*.

5. **Physopella Meibomiae** sp. nov.
ON FABACEAE:
Meibomia supina (Sw.) Britton (*Desmodium supinum* DC.), Añasco, hillside, March 28, II, III, *219* (type); Tanamá River Valley, April 7, II, *275*.

Uredinia hypophyllous, scattered or somewhat aggregated on discolored areas, small, about 0.1 mm. across, at first punctiform, pale, subepidermal, opening by a pore about which the spores accumulate; paraphyses imbricated to form a pseudoperidium, small, incurved, clavate, 7–10 by 26–64 μ, the wall colorless, thin, slightly thicker above; urediniospores globoid or broadly obovoid, 13–19 by 19–23 μ; wall colorless, thin, 1–1.5 μ, very closely and finely echinulate, the pores obscure.

Telia hypophyllous, associated with the uredinia, inconspicuous, giving no surface indication, subepidermal, lenticular, small, about 0.1 mm. across and one half as high; teliospores smooth, composed of 2–3 cells in series, the outer cells larger, irregularly oblong, 9–12 by 13–19 μ, the wall thin, 1 μ or less, somewhat thicker above, 2–2.5 μ, pale cinnamon-brown, becoming dark cinnamon-brown above, the inner cells globoid or ellipsoid, paler, not thickened above.

This inconspicuous species differs in its uredinia very little from a collection of unnamed uredinia on *Desmodium heterocarpum* from Ceylon, sent the writer by Mr. T. Petch, government mycologist, and may be the same No other similar collection has been seen.

The species is here placed under *Physopella*, because it accords in the characters of its uredinia and telia with the type species of that genus, while it does not thus accord with *Phakopsora* or

Schroeteriaster. The type species of *Phakopsora* possesses a membranous peridium with paraphyses intermixed with the spores of the uredinium, while the type of *Schroeteriaster* is without peridium or paraphyses, and with colored spores, having evident pores. All three genera show lenticular telia in their types.

The writer does not wish to express an opinion as to the correct limitations of the genus *Physopella,* or even of its validity, but thinks it best to assort species into genera representing like groups, so far as that is possible. Too few species are yet known with both uredinia and telia, and too great obscurity yet exists regarding the life cycle of these forms to make a fully rational and workable assortment of the various forms possible.

6. **Physopella concors** (Arth.) comb. nov.

Uredo concors Arth. Mycol. **7**: 330. 1915.

ON FABACEAE:

Dolichos Lablab L., El Yunque, April 14, II, *197.*

The general characters of this rust so closely resemble those of *P. Meibomiae,* that since becoming acquainted with that species there seems not to be the slightest chance for error in transferring the rust from the form-genus *Uredo* to the genus *Physopella.* Both macroscopically and microscopically the two forms are, however, thoroughly distinct specifically. The telia of *P. concors,* which have not yet been found, are likely to occur, as in *P. Meibomiae,* among well-matured uredinia, but a diligent search of the material in hand did not reveal them.

Olivea gen. nov.

Cycle of development includes pycnia, aecia, uredinia, and telia; autoecious. Aecia subepidermal, other sori subcuticular.

Pycnia mammilliform, without estiolar filaments.

Aecia deep-seated, protected by the host tissues. Peridium apparently wanting. Aeciospores catenulate with intercalary cells, obovate, strongly echinulate-verrucose, with rod-like warts, the walls colored; in appearance simulating urediniospores.

Uredinia from a minute, subcuticular hymenium, expanding into a globose mass of strongly incurved paraphyses, having their bases united. Urediniospores borne singly on pedicels, obovate, stellately angular, echinulate, the wall colored, with pores approximately equatorial, at the angles.

Telia replacing the uredinia in the basket of paraphyses, numerous, free, 1-celled, sessile, colorless, cylindraceous, the wall thin, smooth.

Type species *Uredo capituliformis* P. Henn. (on *Alchornea* sp., Brazil, *Ule 3060*, supplemented by aecia on *A. latifolia* Sw., Porto Rico, *Stevens 5437*, and by telia on *A. latifolia* Sw., Porto Rico, *Whetzel & Olive 345*).

7. **Olivea capituliformis** (P. Henn.) comb. nov.

Uredo capituliformis P. Henn. Hedw. **34**: 97. 1895.

Ravenelia capituliformis P. Henn. Hedw. **43**: 160. 1904.

ON EUPHORBIACEAE:

Alchornea latifolia Sw., El Yunque, March 12, O, I, II, III, *345*; Naguabo on slope of El Duque, April 19, O, I, *346*.

Pycnia epiphyllous, in small groups, mammilliform, honey-yellow, subcuticular but depressing or absorbing the epidermal cells, 80–165 μ across by 50–95 μ high; ostiolar filaments wanting.

Aecia amphigenous, more abundant above, gregarious on slightly discolored spots 2–5 mm. across, pustular, brown, deep-seated among the palisade cells of the host, ostiolate; peridium none; aeciospores obovate, stellately protuberant with one apical and four lateral swellings, 20–24 by 27–35 μ; wall cinnamon-brown, 1–2 μ thick, closely and strongly echinulate-verrucose with colorless rod-like warts, 2–3 μ long.

Uredinia chiefly hypophyllous, often opposite the aecia, gregarious, forming globose, chestnut-brown balls, 0.1–0.3 mm. across, seated lightly on the leaf surface; paraphyses cylindrical, incurved, strong, united at the bases, forming a globose basket, 9–11 by 75–100 μ, the wall dark chestnut-brown, thickened nearly or quite to close the lumen; urediniospores simulating the aeciospores, obovate, stellately protuberant with one apical and four lateral swellings, 23–29 by 28–33 μ; wall cinnamon-brown, 1–1.5 μ thick, closely and finely echinulate, the pores obscure.

Telia replacing the uredinia in the same sorus; teliospores cylindric or cylindric-clavate, 12–16 by 45–60 μ, rounded above, wall uniformly thin, 1 μ or less, smooth, colorless.

In the notes appended to the original description of the uredinia of this rust, Hennings (Hedw. **34**: 97) speaks of it as "a very wonderful species," and nine years later, again having occasion to record its occurrence in Brazil, calls it "a very remarkable

species, having an extraordinary resemblance to Perisporiaceae, like Perodiella." The uredinia are indeed most unusual, both in the form of the spore, and in the ball or basket of paraphyses, which hold together firmly at their bases and easily separate as a whole from the host. The aecia are no less strange in being so deep-seated, and in having spores so closely resembling the urediniospores, even to the sculpturing. The aeciospores come nearest to being echinulate of any known. The teliospores germinate upon maturity.

It is a pleasure to dedicate this genus to Dr. E. W. Olive, of the Brooklyn Botanic Garden, who has done much to make known the nuclear behavior and historical development of the rusts, and whose recent paper in connection with Professor H. H. Whetzel on the short-cycle, aecia-like rusts of Porto Rico, a product of their recent exploration of the island, has been an especially notable achievement.

The collections at present known to the writer, beside the above by Whetzel and Olive are three recorded in the Stevens Porto Rican list (Mycol. **7**: 328–329), two of them from Porto Rico with O, I, II, and one from Tortola with O, I, and two by E. Ule from Brazil, as recorded by Hennings, l. c.

8. **Olivea Petitiae** sp. nov.

ON VERBENACEAE:

Petitia domingensis Jacq., Maricao, mountains along the Rio Grande river, March 23, II, iii, *349*.

Uredinia hypophyllous, somewhat grouped on indefinite, brownish spots, or scattered, forming globose, chestnut-brown balls, 0.1–0.3 mm. across, seemingly superficial; paraphyses cylindrical, incurved, joined by their bases, forming a globose basket holding the spores, 8–10 by 90–175 μ, the wall dark cinnamon-brown, thick, nearly or quite closing the lumen; urediniospores globoid-obovate, somewhat stellately angular, 24–32 by 29–32 μ; wall cinnamon-brown, about 1.5 μ thick, moderately echinulate, the pores approximately equatorial, usually 4, one at each projecting angle.

Telia replacing the uredinia in the same sorus; teliospores clavate or fusiform-clavate, 13–19 by 45–58 μ; rounded or narrowed above; wall uniformly thin, 1 μ or less, smooth, colorless.

The gross appearance of this species is like that of *Olivea*

capituliformis, and many of the microscopic details as well. The remarkable balls of paraphyses inclosing the urediniospores are similar, and the colorless teliospores also. As in the former species the surest way to find the teliospores is to crush a ball of paraphyses, taken from a well-matured group of sori. The teliospores are usually found germinated, which obscures their true shape.

9. KUEHNEOLA FICI (Cast.) Butler.

ON ARTOCARPACEAE:

Carica Papaya L. (*Ficus Carica* L.), Yauco, March 30, II, *322*.

Ficus crassinervia Desf., El Yunque, April 12, II, *338*.

Ficus laevigata Vahl, Barceloneta, April 8, II, *339*.

Ficus lentiginosa Vahl, Mayagüez, March 3, II, *341;* Yauco, March 30, II, *340*.

10. KUEHNEOLA GOSSYPII (Lagerh.) Arth.

ON MALVACEAE:

Gossypium hirsutum L., Añasco, March 28, II, III; Yauco, March 30, II, *110;* Barceloneta, Feb. 25—April 5, II, *109*.

Gossypium sp., Rio Piedras, April 22, II, *112*.

11. KUEHNEOLA MALVICOLA (Speg.) Arth.. N. Am. Flora **7**: 187. 1912.

ON MALVACEAE:

Malache scabra B. Vogel (*Pavonia racemosa* L.), Martin Peña, April 10, II, *94*.

This is the first record of the rust for the West Indies. The host is furthermore a new one for the species. Only uredinia were found, the spores measuring a trifle larger than usual, 18–23 by 23–32 μ. Sections of the sori showed a few peripheral paraphyses, not rising above the spore mass.

12. CEROTELIUM CANAVALIAE Arth.

ON FABACEAE:

Canavalia ensiformis DC., Barceloneta, Feb. 25, II, *380*.

The Sydows have recently pointed out (Monog. Ured. **3**: 524. 1915), that the telia of this species closely resemble those of the

type species of the genus *Dietelia*, and have consequently transferred it to that genus, as *D. Canavaliae* (Arth.) Syd. The writer, however, holds that this rust, being a long cycle form, should not be placed in a short cycle genus, like *Dietelia*, even if the telia be similar.

13. SCHROETERIASTER FENESTRALA Arth.

ON EUPHORBIACEAE:

Phyllanthus distichus (L.) Muell.-Arg. (*Cicca disticha* L.), Mayagüez, March 13, II, *323;* Guanica, March 30, II, *324*.

Phyllanthus Niruri L., Rio Piedras, April 22, II, *238*.

The last host is new for the rust. Although these three collections show uredinia only, yet in so far they confirm the view at first expressed (MYCOL. **7**: 332. 1915), that the form on *P. distichus* is the same rust as the one on *P. grandiflorus*, although the urediniospores range a trifle smaller, with paler walls. The form on *P. Niruri* is like that on *P. distichus* in the character of the urediniospores, with possibly still paler spore-walls. Sections from *P. Niruri* gave good details for the peridium, and confirmed the original description.

Family: **Aecidiaceae (Pucciniaceae)**

14. RAVENELIA INDIGOFERAE Tranz.

ON FABACEAE:

Indigofera suffruticosa Mill. (*I. Anil* L.), Mayagüez, March 2–20, II, *190;* Añasco, March 28, II, *192;* Yauco. March 30, II, *191;* Barceloneta, April 5, II, *193;* Naguabo, April 19, II, *194*.

15. RAVENELIA INGAE (P. Henn.) Arth.

ON MIMOSACEAE:

Inga laurina Willd., Maricao, March 24, O, II, *210;* El Yunque, April 14, O, II, *209*.

The host is a new one for the species.

16. **Ravenelia Whetzelii** sp. nov.

ON MIMOSACEAE:

Inga vera Willd., Maricao, south, March 23, O, II, *207*,

along the Rio Grande, March 24, O, II, *208*, west along highway, March 25, O, II, *205;* Mayagüez, "La Jagua," March 28, O, II, *206* (type).

Pycnia amphigenous, numerous, in crowded orbicular groups 1–3 mm. across, punctiform, dark-brown, subcuticular, depressed-hemispherical.

Uredinia amphigenous, causing more or less hypertrophy, at first surrounding the pycnia, forming groups or rings 1–6 mm. across, small, crowded and confluent, tardily naked, dark cinnamon-brown, subepidermal, pulverulent, ruptured epidermis conspicuous; paraphyses none; urediniospores narrowly obovate, 18–24 by 30–40 μ; wall golden-brown, moderately thick 1.5–3 μ, thicker above, 3–7 μ, echinulate-verrucose and longitudinally striate, the continuous or beaded striations about 1 μ apart, the pores 3 or 4, equatorial.

Telia unknown.

The species differs from *R. Ingae* by the darker and much larger urediniospores with their prominent striations. A re-examination of collections previously known, shows some tendency for a part of the spores on *Inga Inicuil* from Mexico, the type of *Uredo excipulata* Syd., to be moderately striate, but in all other cases the characters are uniform as given for *R. Ingae.* There is, however, a collection from Quito, Ecuador, on *Inga pachycarpa,* January, 1892, *G. Lagerheim,* distributed by Prof. Lagerheim under the tentative name, *Uromyces Ingae* ined., which agrees in every particular with the present species, the spores being large, dark and strongly striate. It may be noted as curious that the previous collections from four localities on the island, all on *I. vera,* belong to the preceding species, while the four collections by Whetzel and Olive from other but not distant localities, also on *I. vera,* belong to the new species.

17. RAVENELIA STEVENSII Arth.

ON MIMOSACEAE:

Acacia riparia H. B. K., Coamo, April 24, II, *181*.

18. RAVENELIA SILIQUAE Long, Bot. Gaz. **35**: 118. 1903.

ON MIMOSACEAE:

Vachellia Farnesiana (L.) W. & A. (*Acacia Farnesiana* Willd.), Yauco, March 31, II, *195;* Coamo, April 24, II, *196*.

The first record of a station outside of Mexico. The collections show the characteristic large uredinial sori on the pods, with no other stages.

19. RAVENELIA CAESALPINIAE Arth. (*Uromyces Caesalpiniae* Arth.).

ON MIMOSACEAE:

Mimosa ceratonia L., Mayagüez, March 7, O, II, III, *183;* Maricao, March 23, ii, III, *184;* Barceloneta, April 6, O, II, iii, *185;* Rio Piedras, April 11, O, II, III, *187;* Naguabo, April 19, II, *186.*

This rust, first known and named from the uredinial stage, proved a great surprise when the telia were found among the 1915 collections of the Stevens set. The teliospores, instead of being the compound, capitate structures, with cystoid appendages, commonly seen among species of Ravenelia, were single, obovate and pedicillate spores, in no wise differing from those usually placed under *Uromyces.* The second surprise came in examining the Whetzel-Olive collections. These gave ample telial material, which not only showed what had been seen before, but also many compound spores. Such compound spores are in reality primitive teliospore heads, containing 2–8 cells each, those with three cells being most common. The pedicels are adherent the same as the cells. Both cells and pedicels are not merely appressed, but are grown fast together, so that they are made angular, and the cells are squarish above. No indication of cysts can be detected. The free, *Uromyces*-like spores were intermixed with the compound ones. The teliospores germinate readily upon maturity. The telial structure, as well as other characters, now justifies replacing the species under the genus *Ravenelia.* The specific name proves to be an unfortunate one, as it gives an erroneous impression regarding the affinities of the host.

20. PROSPODIUM APPENDICULATUM (Wint.) Arth. (*Puccinia appendiculata* Wint.).

ON BIGNONIACEAE:

Stenolobium Stans (L.) D. Don (*Tecoma Stans* Juss.), Santurce, April 19, II, III, *374.*

21. PROSPODIUM PLAGIOPUS (Mont.) Arth. N. Am. Flora **7**: 165. 1912.

ON BIGNONIACEAE:

Tecoma pentaphylla (L.) Juss., Añasco, March 28, II, *358;* Rio Piedras, April 11, II, *373*.

This is the first time the rust has been found outside of a limited area in Cuba. The host is also a new one for the species. The urediniospores vary somewhat from the Cuban form in having longer and more noticeable echinulation, and in the slight development of the hygroscopic layer.

22. ARGOMYCES VERNONIAE Arth.

ON CARDUACEAE:

Vernonia borinquensis Urban, Maricao, March 15, ii, III, *149,* March 16, ii, III, *150*.

Vernonia sericea L. C. Rich (*V. phyllostachya* Gleason), Barceloneta, April 8, II, *157*.

23. UROMYCES ERAGROSTIDIS Tracy.

ON POACEAE:

Eragrostis tephrosanthes Schult., San German, April 1, II, *446*.

24. UROMYCES LEPTODERMUS Syd.

ON POACEAE:

Lasiacis ligulata Hitch. & Chase, Maricao, March 23, II, *420*.

Lasiacis Swartziana Hitch., Mayagüez, March 7, II, *395;* Maricao, March 16, II, *426*.

Panicum parvifolium Lam., Martin Peña, April 10, II, *434*.

25. UROMYCES IGNOBILIS (Syd.) Arth.

ON POACEAE:

Sporobolus indicus (L.) R. Br., Mayagüez, March 3, II, *423,* March 8, II, *422,* March 13, II, *421;* Naguabo, April 19, II, *443*.

26. UROMYCES RHYNCOSPORAE Ellis.

ON CYPERACEAE:

Rynchospora distans (Michx.) Vahl., Martin Peña, April 10, ii, III, *29*.

Rynchospora setacea (Berg.) Boeck., Martin Peña, April 10, ii. III, *34*.

In the report on the Stevens collections (MYCOL. 7: 182) the collection made at Mayagüez, P. R. by Clinton, on *R. aurea,* as well as the one from the Bahamas on *R. cyperoides,* both showing only uredinia, should be transferred to *Puccinia angustatoides.* Not until the collections by Whetzel and Olive came to hand was it possible to separate the two forms. It is found that the Uromyces form has somewhat smaller, thinner-walled urediniospores, with greater uniformity in size, than those of the *Puccinia* form.

27. UROMYCES SCLERIAE P. Henn.

ON CYPERACEAE:

Scleria canescens Rosckl, El Yunque, April 12, II, *384.*

Scleria pterota Presl, Mayagüez, March 9–April 3, II, III, *386a;* Añasco, March 28, II, *387;* Rio Piedras, April 11, II, III, *385;* Naguabo on slope of El Duque, April 19, II, III, *382a.*

The first mentioned host is new for the species. The rust sometimes occurs intermixed on the same plants with *Puccinia Scleriae.*

28. UROMYCES APPENDICULATUS (Pers.) Fries.

ON FABACEAE:

Phaseolus adenanthus G. Meyer, Mayagüez, March 1, II, *189;* Barceloneta, April 5, II, *376.*

Phaseolus lathyroides L., Maricao, March 25, II, *203.*

Phaseolus vulgaris L., Maricao, March 25, II, *202.*

Vigna repens (L.) Kuntze, Mayagüez road to Guanajibos, March 3, II, *201.*

The second host named is a new one for the species.

29. UROMYCES DOLICHOLI Arth.

ON FABACEAE:

Cajan Cajan (L.) Millsp. (*Cajanus Cajan* Pollard, *C. indicus* Spreng.), Mayagüez, Feb. 28, II, *211;* Yauco, March 30, II, *212.*

Dolicholus eninimus (L.) Medic., Guanica, March 30, II, *204.*

Dolicholus reticulatus (Sw.) Millsp., Mayagüez, March 7, II, *188.*

The second host named is new for the species.

30. UROMYCES HEDYSARI-PANICULATI (Schw.) Farl. (*Uredo Desmodii-tortuosi* P. Henn.).

ON FABACEAE:

Meibomia Scorpiurus (Sw.) Kuntze (*Desmodium Scorpiurus* Desv.), Mayagüez, March 20, II, *218*.

Meibonia tortuosa (Sw.) Kuntze (*Desmodium tortuosum* DC), Yauco, March 31, II, *220*.

Through the kindness of Dr. Lindau of the Berlin Museum, the writer has recently been able to examine the spores from the original collection made by *Sintenis* at Fajardo in Porto Rico and established by P. Hennings as a new species under the name *Uredo Desmodii-tortuosi*. The examination of this material confirms the prediction in connection with the discussion of the Stevens material (MYCOL. 7: 189). The spores do not in any way differ from the urediniospores on other collections of the same or other hosts, they being finely verrucose, and not smooth as stated in the original description.

31. **Uromyces Sabineae** sp. nov.

ON FABACEAE:

Sabinea punicea Urban, Maricao, Rio Grande river, March 23, II, III, *182*.

Uredinia hypophyllous, scattered, or somewhat gregarious on slightly reddish, effused spots, applanate, round, 0.1–0.2 mm. across, soon naked, light cinnamon-brown, pulverulent, ruptured epidermis evident; urediniospores globoid or broadly obovoid, 18–20 by 19–26 μ; wall light yellow, thin, about 1.5 μ, moderately echinulate, the pores fairly distinct, 3 or occasionally 4, equatorial.

Telia hypophyllous, scattered or somewhat gregarious, pulvinate, round, 0.1–0.3 mm. across, early naked, blackish-brown, ruptured epidermis evident; teliospores globoid, 20–24 by 22–29 μ; wall dark chestnut-brown, moderately thick, 3 μ, thicker above, 4–7 μ, moderately verrucose; pedicel colorless, one half to once length of spore.

The collection shows about an equal abundance of well-formed uredinia and telia.

32. UROMYCES NEUROCARPI Dietel.

ON FABACEAE:

Clitoria rubiginosa Juss., Mayagüez, March 20, II, *216*,

March 27, II, *217*, April 4, II, III, *381;* Barceloneta, April 6, II, *215;* Martin Peña, April 10, II, *214*.

33. UROMYCES PROËMINENS (DC.) Pass.

ON EUPHORBIACEAE:

Chamaesyce brasiliensis (Lam.) Small (*Euphorbia brasiliensis* Lam.), Mayagüez, March 7, I, *243*.

Chamaesyce hirta (L.) Millsp. (*Euphorbia hirta* L., *E. pilulifera* L.), Mayagüez, March 3, II, *247*, March 4, II, *244;* Boqueron, March 11, I, II, *246;* Yauco, March 31, II, *248;* San German, April 1, II, *245*.

The first host is new for the West Indian islands. The rust has also been collected at Rio Piedras, on *C. prostrata* (Ait.) Small (*Euphorbia prostrata* Ait.), March 26, 1916, by J. A. Stevenson *5061*, another new host for the island.

34. UROMYCES HOWEI Peck.

ON ASCLEPIADACEAE:

Asclepias curassavica L., Maricao, March 22, II, *297;* Coamo, April 24, II, *294*.

35. UROMYCES CESTRI Mont.

ON SOLANACEAE:

Cestrum laurifolium L'Her., Fajardo, April 20, I, III, *369;* Campo Allegra, April 21, I, III, *370*.

Cestrum macrophyllum Vent., Maricao, March 16–23, I, III, *365;* Barceloneta, April 6, I, *366;* Tanamá River Valley, April 7, I, *367;* El Yunque, April 14, I, III, *368*.

36. UROMYCES HELLERIANUS Arth.

ON CUCURBITACEAE:

Cayaponia racemosa (Sw.) Cogn., Mayagüez, March 8, II, III, *255;* Barceloneta, April 6, II, III, *256;* El Yunque, April 14, II, iii, *254;* El Duque near Naguabo, April 19, II, iii, *253;* Rio Piedras, April 22, II, *257*.

Melothria guadalupensis (Spreng.) Cogn., Mayagüez, March 6, II, iii, *252*, March 29, II, *251;* El Duque near Naguabo, April 19, II, *249;* Rio Piedras, April 22, II, *250*.

37. UROMYCES COLUMBIANUS Mayor.

ON CARDUACEAE:

Melanthera canescens (Kuntze) O. E. Schultz, Mayagüez, March 13, II, *162*, March 20, II, *163*; Añasco, March 28, II, *164*; Maricao, March 25, II, *165*; Yauco, March 31, II, *167*; Barceloneta, April 6, II, *166*.

38. **Uromyces bidenticola** (P. Henn.) comb. nov. (*U. Bidentis* Sydow, not Lagerh.).

Uredo bidenticola P. Henn. Hedwigia **37**: 279. 1898.

ON CARDUACEAE:

Bidens leucantha Willd., Yauco, March 3, II, *136*; Hormigueros, March 11, II, *135*; Barceloneta, April 5, II, *137*.

Bidens pilosa L., Boqueron, March 11, II, *141*; Maricao, March 22, II, *140*; San German, April 1, II, iii, *138*; Tanamá River Valley, April 7, II, *142*.

39. UROMYCES BIDENTIS Lagerh. (*U. densus* Arth.).

ON CARDUACEAE:

Bidens pilosa L., Maricao, in cemetery, March 25, *139*.

A few sori of *Uromyces bidenticola* occur on the same leaves with the short cycle form, the latter being abundant and cinereous from germination. Neither the original description nor type material of Lagerheim's *Uromyces Bidentis* had been seen by the writer until recently. It is now found that Lagerheim begins his diagnosis (Bull. Soc. Myc. Fr. **11**: 213) with the descriptive word "Leptouromyces," and that the specimens which he distributed from the type locality, judging from the one in the herbarium of the N. Y. Bot. Garden, fully establish the fact that his name applies to the short cycle species. This requires that the other, long cycle species be called *Uromyces bidenticola*, the type locality being Jamaica, on *Bidens leucantha*. The application of the short cycle name to the long cycle species was first made by the Sydows (Monog. Ured. **1**: 3. 1909). It appears that the first clear recognition of the two forms was by Bubák as early as 1904, for he says in connection with a specimen of *Uredo Bidentis* from the Canary Islands, distributed in the Austrian Kryptogamae Exsiccatae no. 937, that "on the Höhnel's collection (Sydow, Ured. *1647*) there also occurs *Uromyces*

Bidentis Lagerh., which is a *Lepturomyces* and is not connected genetically with the preceding *Uredo*-form." However, not all the specimens of Sydow, Ured. *1647* show the short cycle form, for the one at the N. Y. Bot. Garden does not.

40. UROMYCES PIANHYENSIS P. Henn.

ON CARDUACEAE:

Wedelia reticulata DC., Yauco, March 31, II, *159*; Tanamá River Valley, April 7, II, *160*.

41. PUCCINIA PURPUREA Cooke.

ON POACEAE:

Holcus sudanensis (Piper) Hitchc., Mayagüez, March 4, II, III, *405*.

A new host for the species.

42. PUCCINIA CYNODONTIS DeLac.

ON POACEAE:

Capriola dactylon (L.) Kuntze (*Cynodon dactylon* Pers.), Mayagüez, Feb. 29, II, *424*; Naguabo, April 20, II, *441*.

43. PUCCINIA CENCHRI Diet. & Holw.

ON POACEAE:

Cenchrus echinatus L., Mayagüez, March 3, II, III, *406*; Boqueron, March 11, II, *407*; Yauco, March 31, II, III, *409*; San German, April 1, II, *408*; Barceloneta, April 6, II, *435*; Tanamá River Valley, April 7, II, *432*.

44. PUCCINIA HUBERI P. Henn. (*P. Puttemansii* P. Henn. Hedw. **41**: 105. 1902).

ON POACEAE:

Panicum fasciculatum Sw., Barceloneta, April 6, II, III, *445*.

Panicum trichoides Sw., Mayagüez, March 6, II, III, *414*, March 10, II, III, *415*, March 20, II, III, *416*; Tanamá River Valley, April 7, II, III, *433*.

In the study of the present material a more extended comparison with South American forms was made than had before been feasible. Some time ago the authorities of the Berlin Museum were so kind as to send me among other things a part of the original collections for *Puccinia Huberi* and *P. Puttemansii*,

and it is now found that the two are identical. The latter form was obtained on an undetermined species of *Panicum* in Brazil. Both forms show uredinia and telia, and if any difference can be seen in them, it is a somewhat greater regularity in the form of the teliospores for *P. Puttemansii,* a variation well known in a number of grass rusts.

45. PUCCINIA LEVIS (Sacc. & Bizz.) Magn.

ON POACEAE:

Paspalum fimbriatum H. B. K., Yauco, March 30, II, *418.*

Paspalum millegrana Poir., Campo Allegra, April 21, II, *439.*

The species is now reported for the first time on *Paspalum millegrana.*

46. PUCCINIA SUBSTRIATA Ellis & Barth.

ON POACEAE:

Chaetochloa geniculata (Lam.) Millsp. & Chase (*C. imberbis* Scribn.), Rio Piedras, April 22, II, III, *438.*

Eriochloa subglabra (Nash) Hitchc., Mayagüez, Feb. 29, II, *401,* March 1, II, *400,* March 3, II, *403,* March 9, II, *402,* March 13, II, *398, 399;* Rio Piedras, March 11–17, II, *404.*

Ichnanthus pallens (Sw.) Munro (*Panicum pallens* Sw.), Mayagüez, March 2, II, *396;* El Yunque, April 12, II, III, *397.*

Paspalum paniculatum L., Mayagüez, March 13, II, *392;* Maricao, March 15, II, III, *391;* San German, April 1, II, *393;* Naguabo, April 19, II, *411*; Rio Piedras, April 23, ii, *390.*

Syntherisma digitata (Schwartz) Hitchc., Barceloneta, April 6, II, *431;* Naguabo, on slopes of El Duque, April 19, II, III, *444.*

Valota insularis (L.) Chase, Boqueron, March 11, II, *394;* San German, April 1, ii, *447;* Campo Allegra, April 21, II, *436.*

All the above hosts, except *Paspalum paniculatum,* are new for the island, and with the exception of *Chaetochloa geniculata* are now first given for the species. Field evidences were obtained to

show that possibly this rust is connected with *Aecidium tubulosum* on *Solanum*.

47. PUCCINIA CANALICULATA (Schw.) Lagerh.

ON CYPERACEAE:

Cyperus ferax L. C. Rich., Naguabo, cane field along railroad, April 19, II, *13;* Naguabo, slopes of El Duque, April 19, II, *14*.

Cyperus giganteus Vahl, Mayagüez, March 13, II, *19*.

Cyperus laevigatus L., Mayagüez, March 3, II, *18*.

Cyperus odoratus L., Martin Peña, April 10, II, *20;* Naguabo, April 19, II, *21*.

Cyperus radiatus Rottb., Naguabo, April 19, II, *33*.

Cyperus reticulatus L., Naguabo, April 19, II, III, *22*.

Cyperus sphacelatus Rottb., Mayagüez, March 6, II, *16;* Cataño, April 20, II, *15;* Campo Allegra, April 21, II, *17*.

Cyperus surinamensis Rottb., Naguabo, April 19, II, *11, 12*.

Kyllinga brevifolia Rottb., Martin Peña, April 10, II, *55*.

Kyllinga pumila Michx., Añasco, March 28, II, *54;* Rio Piedras, April 11, II, *52;* El Yunque, April 12, II, *53*.

In the one collection showing teliospores, which is on a host new for the rust, the sori have an appearance quite unlike the usual form. They are scattered singly, instead of being in considerable, compact areas, and have a different color. The teliospores have a considerably thinner apex, being only 3–7 μ thick. The form agrees well with the description of the Corsican species *P. Romagnoliana* Maire & Sacc., but the telia of that species are said to be surrounded by a heavy stroma. This could not be matched in the Porto Rican material as no sori having teliospores only were seen, the sori apparently being uredinial in which teliospores were developing, and not strictly telial.

48. PUCCINIA ANGUSTATOIDES Stone, Bull. Torrey Club **36**: 549. 1909.

ON CYPERACEAE:

Rynchospora corymbosa (L.) Britton, Mayagüez, March 13, II, *30*.

Rhynchospora cyperoides (Sw.) Mart., El Yunque, April 12, II, *31;* Cataño, April 20, II, iii, *32.*

This is the first recognition of the rust in the West Indies. It also occurs as uredinia on *R. aurea* Vahl from Mayagüez, P. R., as well as on *R. cyperoides* from the Bahamas, both mentioned in the Stevens' Porto Rican list (MYCOL. **7**: 182), and in the N. Am. Flora (**7**: 232, 233), under *Uromyces Rhyncosporae.* The two forms are undoubtedly correlated, but the form with two-celled teliospores appears to have somewhat larger and thicker-walled urediniospores, which also show more variability in size.

The species has heretofore been known from a few localities in Alabama, Louisiana and Texas, on *R. corniculata.* The teliospores on *R. cyperoides* appear to be somewhat longer and less thickened at apex than those on *R. corniculata.* The other hosts show only uredinia.

49. **Puccinia Scleriae** (Paz.) comb. nov.

Rostrupia Scleriae Paz., Hedw. **31**: 96. 1892.

ON CYPERACEAE:

Scleria cubensis Boeckl, Maricao on Rio Grande river, March 24, II, *389.*

Scleria pterota Presl, Mayagüez, March 9–April 3, II, III, *386;* Maricao, March 23, II, III, *388;* El Yunque, April 12, II, *383;* Naguabo on slope of El Duque, April 19, II, III, *382.*

Soon after arriving in Porto Rico Messrs. Whetzel and Olive sent to Lafayette, Indiana, the rusted parts as well as living plants of "a herbaceous vine, possibly *Passiflora,* and a sedge," representing a "possible combination." They wrote that "the two always occur together," being "very abundant," in the vicinity of Mayagüez. This initial lot of material was followed by ample collections of the two forms of rust, and of corroborative observations. The hosts were later determined as *Passiflora rubra* and *Scleria pterota.* Repeated attempts to germinate either the aeciospores or teliospores utterly failed, so that no cultures were secured, but the writer is inclined to think that a good clue has been secured, and that the two forms will eventually be found to be alternate stages of the same species.

The rust on the *Scleria* proved more than usually interesting on account of the irregularity in septation of the teliospores. They were found to have from one to four cells each, more commonly three cells and, every sorus, whatever the dominant form of spore, showed at least a few spores with three cells. It was not difficult to identify this rust with the Brazilian form on *Scleria hirtella,* named by Pazschke *Rostrupia Scleriae.* To the writer a variable number of cells in the teliospore, without other diagnostic characters, does not constitute a generic distinction, and the species is therefore transferred to Puccinia.

The species differs from *Puccinia scleriicola* not only in the variable number of teliosporic cells, but in the more cylindric form of the teliospores with thinner side-walls, and in the marked development of a dark stroma about the sorus. The urediniospores are similar in the two species, but in *P. Scleriae* they have somewhat thinner walls, and still more obscure pores.

Puccinia Scleriae is at present only known from Brazil and Porto Rico, while *Aecidium passifloriicola,* the supposed alternate form, is known from Porto Rico, Jamaica and Peru.

50. PUCCINIA ELEOCHARIDIS Arth.

ON CYPERACEAE:

Eleocharis capitata (L.) R. Br., Mayagüez, March 3, II, *37;* Martin Peña, April 10, II, *36.*

Eleocharis geniculata (L.) R. Br., Mayagüez, March 2, II, *39,* March 13, II, *38;* Naguabo, April 19, II, *40.*

Eleocharis interstincta (Vahl) R. & S., Mayagüez, March 20, II, *35.*

Eleocharis mutata (L.) R. & S., Martin Peña, April 10, II, *41, 42.*

The last named host is a new one for the rust. No teliospores were found in any of the collections.

51. PUCCINIA CLADII Ellis & Tracy.

ON CYPERACEAE:

Mariscus jamaicensis (Crantz) Britton (*Cladium effusum* Torr.), Martin Peña, April 10, II, *43.*

The first record of this rust for Porto Rico. It has previously been reported for Bermuda on the same host, and it also occurs on the same host in North Carolina and Mississippi.

52. PUCCINIA FIMBRISTYLIDIS Arth.

ON CYPERACEAE:

Fimbristylis diphylla (Retz) Vahl, Barceloneta, April 6, II, III, *26;* Campo Allegra, April 21, II, III, *25*.

The type collection for this species was on *Fimbristylis polymorpha* from Mexico. The present collections agree in both uredinia and telia with the type material. Stevens made five collections of the rust on *F. diphylla,* four in Porto Rico at Ponce, Nov. 8, 1913, *4381,* Bandero, July 15, 1915, *8565,* Alto, July 16, 1915, *8603, 8707,* and one in Martinique 2970, all showing only uredinia. A collection made by Clinton at Mayagüez, in 1904, on *Fimbristylis* sp., is identical, and the host is certainly *F. diphylla.* Collections on *F. ferruginea* previously referred to this species are now believed to belong to *Uredo superior* Arth.

53. PUCCINIA SMILACIS Schw. Nat. Ges. Leipzig **1**: *72*. 1822.

ON SMILACEAE:

Smilax domingensis Willd., Maricao, March 16, II, *348*.

The first record of this rust for the West Indies.

54. PUCCINIA CANNAE (Wint.) P. Henn.

ON CANNACEAE:

Canna coccinea Ait., Maricao, March 16, II, *377*.

Canna sp. (cultivated), Barceloneta, Feb. 25, II, iii, *225,* April 7, II, iii, *378;* Mayagüez, March 2, II, *224,* March 6, II, *222,* March 9, II, *223*.

Thalia geniculata L., Mayagüez, March 1, II, *227,* March 13–20, II, *226*.

55. PUCCINIA POLYGONI-AMPHIBII Pers. Syn. Fung. *227*. 1801.

ON POLYGONACEAE:

Persicaria punctata (Ell.) Small (*Polygonum punctatum* Ell.), Mayagüez, March 1, II, *261,* April 3, II, *262;* Coamo, April 24, II, *260*.

The first record for the West Indies. As usual for the rust in warm regions, and especially on this host everywhere, only uredinia occur.

56. PUCCINIA RIVINAE (Berk. & Curt.) Speg.

ON PETIVERIACEAE (PHYTOLACCACEAE):

Rivina humilis L., Yauco, March 30, I, *356,* I, II, III, *357*.

Trichostigma octandrum (L.) Walt. (*Rivina octandra* L.), Yauco, March 30, I, II, III, *354;* Coamo, April 24, I, *355.*

The first record on *T. octandrum* for Porto Rico, this being the host on which the type was collected by Charles Wright in Cuba.

57. PUCCINIA ZORNIAE (Diet.) McAlpine, Rusts Austr. 172. 1906.

Uredo Zorniae Diet. Hedw. **38**: 257. 1899.

ON FABACEAE:

Zornia diphylla (L.) Pers., Mayagüez, March 7, II, *200;* Barceloneta, April 6, II, *199.*

This species is now first reported from the West Indies. It has been known heretofore on the same host from Brazil, and on other hosts from the southern United States near the Gulf of Mexico, and from southern Africa and Australia. Only in Australia have teliospores been found.

The presence of paraphyses in the uredinia has not been heretofore recorded. They can only be seen well by use of sections. They are peripheral, scarcely rise above the spore mass, are delicate, clavate, 9–12 by 30 μ, with thin, colorless walls.

58. **Puccinia Ormosiae** sp. nov.

ON FABACEAE:

Ormosia Krugii Urban, El Yunque, April 14, II, iii, *276* (type); Naguabo on slope of El Duque, April 19, II, iii, *277.*

Uredinia hypophyllous, scattered or somewhat grouped, round, 0.1–0.5 mm. in diameter, subepidermal, early naked, ruptured epidermis inconspicuous; paraphyses encircling the sorus, prominent, appearing under a hand lens like a whitish fringe, branched from near the base, expanding above into a large, irregular, botryoid head, nearly colorless, becoming fugacious when old; urediniospores irregularly obovoid, 20–26 by 24–32 μ; wall chestnut-brown, about 1–1.5 μ thick, sparingly echinulate with prominent, slender points, only one pore, basal, rather obscure.

Teliospores arising from the uredinial sori, ellipsoid, 23–25 by 29–34 μ, rounded at both ends, moderately constricted at septum; wall chestnut-brown, uniformly 1.5 μ thick exclusive of the closely-set, large, bead-like warts, 2.5–3.5 μ in diameter; pedicel fragile, the spore readily breaking away close to the hilum.

A very striking species in all its characters. The remarkable paraphyses and the unusual appearance of the teliospores quickly arrest attention. No trace of pycnia could be detected.

59. PUCCINIA INFLATA Arth.

ON MALPIGHIACEAE:

Stigmaphyllon lingulatum (Poir.) Small, Boqueron, March 11, O, II, III, *327;* Guanica, March 30, II, iii, *328;* Yauco, March 31, II, III, *329*; Fajardo hills, April 20, II, III, *331;* Coamo, April 24, II, III, *330;* Santurce, April 24, II, III, *332*.

60. PUCCINIA ARECHAVELATAE Speg.

ON SAPINDACEAE:

Cardiospermum microcarpum H. B. K., Mayagüez, two kilometers east on Maricao road, March 7, *230,* along river, March 19, *228;* Fajardo, April 18, *229*.

In the former Porto Rican list (MYCOL. **7**: 236) the specific name of the host was erroneously printed "microspermum." The rust is a short cycle form.

61. PUCCINIA GOUANIAE Holw.

ON FRANGULACEAE (RHAMNACEAE):

Gouania lupuloides (L.) Urban, Mayagüez, Feb. 29, March 1, 6, 8, II_1, II_2, iii, *363*.[2]

Gouania polygama (Jacq.) Urban, Mayagüez, March 10, II_1, *361,* March 19, II_1, II_2, *362;* Añasco, March 28, II_1, *360;* San German, April 1, II_1, II_2, *359*.

The Whetzel-Olive collections give the first opportunity to complete the life-cycle of this rust. All the collections on both hosts gave an abundance of primary uredinia, accompanied by pycnia. This stage is readily recognized, as the sori are seated on waxy, gall-like, hypophyllous thickenings or pockets of the leaf, one to four millimeters across. The pycnia are amphigenous, globoid or flask-shaped, sunken below the epidermis. The uredinia are oval to oblong, surrounding the pycnia, on the under side of the leaf, subepidermal, and without paraphyses.

[2] The primary uredinia, which function as aecia, and the secondary uredinia, which function as repeating spores, are indicated by subscripts.

They are early naked, applanate, pulverulent, and encircled by the ruptured epidermis. The secondary or true uredinia, are not on hypertrophied areas, but scattered over the under surface, without producing much discoloration. They arise beneath the epidermis, then project above it, possibly through a stoma, and expand superficially, being attached by a slender stalk, and may be removed readily as a whole. There is an abundant development of peripheral paraphyses, holding together at their bases, and usually one-septate. The spores in the primary form are somewhat larger, and very much thicker-walled than in the secondary form. No telial sori have been seen, all the teliospores being produced in uredinia.

The characters of the rust, taken altogether, show it to belong to the genus *Bullaria,* as projected in the North American Flora, and under that genus it becomes **Bullaria Gouaniae** (Holw.) comb. nov.

62. PUCCINIA HETEROSPORA Berk. & Curt. (*Uromyces Pavoniae* Arth.)

ON MALVACEAE:

Malache scabra B. Vogel (*Pavonia racemosa* L., *P. spicata* Cav.), Mayagüez, road to Guanajibo, March 3, *93*.

Sida hederifolia Cav., Mayagüez, March 13, *95*.

Sida humilis Cav., Yauco, March 30, *104*.

Sida procumbens Sw., Guanica, March 30, *96*.

Sida urens L., Mayagüez, March 4, *97,* March 7, *98,* March 20, *99;* Barceloneta, March 6, *103;* Boqueron, March 11, *100;* Añasco, March 28, *101;* Yauco, March 31, *102*.

The second host is a new one for the species. The first host has been reported for the island before as the type collection for *Uromyces Pavoniae*. While Mr. Guy R. Bisby was recently studying the short cycle species of *Uromyces* represented in the Arthur herbarium he discovered the similarity of this form to the mesosporic condition of *Puccinia heterospora,* and upon searching was able to find a few two-celled teliospores in the type collection. The occurrence of two-celled teliospores is also vouched for by the Sydows (Monog. Ured. **2**: 59. 1909). After recognizing the mesosporic character of the teliospores no reason could

be found for maintaining an independent species. Such a preponderance of mesospores is not uncommon with this rust on other hosts. We have here an instance in which all uredinologists agree that there is no taxonomic distinction between the genera *Uromyces* and *Puccinia* worth maintaining. Another collection on *Pavonia racemosa* was found in the cryptogamic herbarium of the N. Y. Bot. Garden, made near Port Angelo, Jamaica, May 12, 1903, *L. M. Underwood 2992.*

63. PUCCINIA PSIDII Wint.

ON MYRTACEAE:

Jambos Jambos (L.) Lyons (*Eugenia Jambos* L., *Jambosa Jambos* Millsp.) Maricao, March 15, II, *334,* March 16, II, *335,* March 23, II, *336.*

64. PUCCINIA HYDROCOTYLES (Link) Cooke, Grevillea **9**: 14. 1880.

ON AMMIACEAE (UMBELLIFERAE):

Hydrocotyle umbellata L., Mayagüez, south along railroad, March 20, II, *233,* Experiment Station grounds, March 29, II, *232;* Yauco, March 30, II, *234.*

This is the first record of the rust for the West Indies, although common on the continents both to the north and south.

65. PUCCINIA CONCRESCENS Ellis & Ev.

ON ASCLEPIADACEAE:

Asclepias curassavica L., Maricao, March 16, electric light plant, *295,* March 25, cemetery, *296.*

Asclepias nivea L., Maricao, Rio Grande valley, March 24, *298.*

The last host is a new one for the rust.

66. PUCCINIA OBLIQUA Berk. & Curt.

ON ASCLEPIADACEAE:

Metastelma lineare Bello, Maricao, March 22, *259.*

Metastelma parviflorum R. Br., Mayagüez, March 7, *258.*

67. PUCCINIA LITHOSPERMI Ellis & Kellerm. Jour. Myc. **1**: 2. 1885.

ON CONVOLVULACEAE:

Evolvulus nummularius L., Mayagüez, March 7, II, *379;* Añasco, March 28, II, *311.*

The first record of the species for the West Indies. The two collections show an abundance of uredinia, the spores of which measure slightly smaller than do the urediniospores on *Evolvulus pilosus* from the central United States. The difference is undoubtedly due to the influence of the host, *E. pilosus* being a strong, thick-leaved plant, while *E. nummularius* is a delicate thin-leaved plant with slender wiry stems. The species heretofore has been known only from Kansas to the Mexican border in the United States. The specific name of the rust was given under a misapprehension regarding the identity of the type collection.

68. PUCCINIA LANTANAE Farl.

ON VERBENACEAE:

Lantana involucrata L., Yauco, March 30, *325*.

69. PUCCINIA URBANIANA P. Henn.

ON VERBENACEAE:

Valerianodes jamaicensis (L.) Medic., San Juan, Feb. 24, *269;* Mayagüez, March 3, *267;* Boqueron, March 11, *268;* Añasco, March 28, *270;* San German, April 1, *266;* Barceloneta, April 6–8, *263;* Fajardo and Naguabo, April 18–20, *264;* Campo Allegra, April 21, *265*.

Valerianodes strigosa (Vahl) Kuntze, Mayagüez, March 7, *272;* Coamo, April 24, *271*.

70. PUCCINIA LEONOTIDIS (P. Henn.) Arth.

ON LAMIACEAE (LABIATAE):

Leonotis nepetaefolia (L.) R. Br., Mayagüez, March 3, II, *123;* Boqueron, March 11, II, *125;* Yauco, March 30, II, *124;* Barceloneta, April 8, II, *126*.

71. PUCCINIA MEDELLINENSIS Mayor.

ON LAMIACEAE (LABIATAE):

Mesosphaerum atrorubens (Poir.) Kuntze (*Hyptis atrorubens* Poir.), Martin Peña, April 10, II, *117;* Naguabo on slopes of El Duque, April 19, II, *116*.

Mesosphaerum pectinata (L.) Poir. (*Hyptis pectinata* Poir.) Mayagüez, March 1, 6, 8, II, *119*; Maricao, March 15, 16, 25, I, II, III, *120;* Yauco, March 30, II, *121*.

Mesosphaerum suaveolens (L.) Kuntze (*Hyptis suaveolens* Poir.), Añasco, March 28, II, *122*.

72. PUCCINIA HYPTIDIS (Curt.) Tracy & Earle.

ON LAMIACEAE (LABIATAE):

Mesosphaerum capitatum (L.) Kuntze (*Hyptis capitata* Jacq.), Mayagüez, March 1, 8, II, *113;* Maricao, March 16, II, *114;* Rio Piedras, April 11, II, *115*.

73. PUCCINIA INSTITITIA Arth.

ON LAMIACEAE (LABIATAE):

Mesosphaerum latanifolium (Poir.) Kuntze (*Hyptis latanifolia* Poir.), Maricao, March 15, II, *118*.

74. PUCCINIA SALVIICOLA Diet. & Holw.

ON LAMIACEAE (LABIATAE):

Salvia occidentalis Sw., Maricao, March 3, II, *132;* Mayagüez, March 7, II, *131,* March 20, II, *130;* Yauco, March 30, II, *133*.

75. PUCCINIA FARINACEA Long.

ON LAMIACEAE (LABIATAE):

Salvia coccinea Juss., Mayagüez, March 3, II, *129;* Maricao, March 24, II, *128*.

76. **Puccinia cuticulosa** (Ellis & Ev.) comb. nov.

Uredo cuticulosa Ellis & Ev. Bull. Lab. Nat. Hist. Iowa **4**: 67. 1896.

Uredo Adenocalymnatis P. Henn. Hedw. **35**: 249. Oct. 1896.

Puccinia aequinoctialis Holw. Ann. Myc. **3**: 22. 1905.

ON BIGNONIACEAE:

Cydista aequinoctialis (L.) Miers (*Bignonia aequinoctialis* L.), Martin Peña, near lagoon, April 10, ii, *372*.

An imperfectly understood species. Only three collections have previously been known, each having received a different name, and each on a different although closely related host. The type came from Nicaragua, and like the Brazilian and Porto Rican collections has only uredinia. The Cuban collection of Holway besides uredinia shows a few teliospores. Possibly *Aecidium simplicior* Arth. may belong here.

77. PUCCINIA BLECHI Lagerh.

ON ACANTHACEAE:

Blechum Brownei (Sw.) Juss., Mayagüez, March 3, 4, 9, II, *127*.

78. **Puccinia fallaciosa** comb. nov. (*Uredo fallaciosa* Arth. Mycol. **7**: 323. 1915).

ON RUBIACEAE:

Palicourea crocea (Sw.) R. & S., Mayagüez, March 6, 27, II, *352*; Maricao, March 23, II, iii, *353*.

Palicourea riparia Benth., El Yunque, April 12, II, *350*.

Psychotria patens Sw., Maricao, March 21, II, *364*.

The uredinia on these several collections are uniformly alike. The host genera are closely related, and the leaves of the several species have the same texture and general appearance. A number of rusts have been described on these hosts from South America, but none of them have been seen by the writer. *Uredo psychotriicola* P. Henn. from Brazil is similar, except the spores are said to be verrucose. *Uredo Palicoureae* P. Henn. from Peru appears to have much smaller spores, which is also the case for the urediniospores of *Puccinia Psychotriae* P. Henn. from Brazil, although the teliospores of this species agree fairly well. There is also a *Uromyces Psychotriae* P. Henn. from Brazil.

79. PUCCINIA LATERITIA Berk. & Curt.

ON RUBIACEAE:

Borreria levis (Lam.) Griseb., Mayagüez, March 1, 2, 13, *293*.

Borreria verticillata (L.) G. F. W. Mey., Barceloneta, Feb. 25, *286*, April 6, *289*; Mayagüez, March 7, *290*, March 13, *292*; Maricao, March 7, *287*, March 16, *291*; San German, April 1, *288*.

Diodia littoralis Sw., Boqueron, March 11, *285*.

Diodia maritima Thonn., Mayagüez, March 3, *283*; Santurce, April 24, *284*.

Diodia rigida C. & S., Mayagüez, March 7, *282*; Barceloneta, April 6, *281*; Campo Allegra, April 21, *280*.

80. PUCCINIA ROSEA (Diet. & Holw.) Arth.

ON CARDUACEAE:

Ageratum conyzoides L., Yauco, March 31, II, *158*.

The host is new for the species.

81. PUCCINIA TAGETICOLA Diet. & Holw.

ON CARDUACEAE:

Tagetes erecta L., Maricao, March 25, II, *161*.

The host, a native of Mexico, but cultivated in gardens under the name of African marigold, is a new one for the rust.

82. PUCCINIA SPEGAZZINI DeT.

ON CARDUACEAE:

Mikania scandens (L.) Willd., Mayagüez, March 13, 20, *168*.

The rust is now first reported for Porto Rico, but previously collected in Martinique by Prof. F. L. Stevens. It is a common tropical species.

83. PUCCINIA SYNEDRELLAE P. Henn.

ON CARDUACEAE:

Emilia sonchifolia DC., Mayagüez, March 4–6, *143*, March 7, *144*, March 9, *145*; Maricao, March 15, *146*, March 25, *147*; Añasco, March 28, *148*.

Synedrella nodiflora (L.) Gaertn., Mayagüez, March 4–6, *152*, March 13, *153*; Yauco, March 31, *154*; El Duque, April 19, *155*.

84. ENDOPHYLLUM CIRCUMSCRIPTUM (Schw.) Whetzel & Olive (*Aecidium circumscriptum* Schw.).

ON VITACEAE:

Cissus sicyoides L., Mayagüez, March 4, 6, 9, *75*, March 20, 26, *76*, March 29, *82*; Maricao, March 16, *77*; Yauco, March 31, *80*; Tanamá River Valley, April 7, *81*; Rio Piedras, April 21, *79*; Coamo, April 24, *78*.

In the Stevens list of Porto Rican rusts (MYCOL. 7: 316) the family of the host was incorrectly given as "Cucurbitaceae."

This species of *Endophyllum*, and the three which follow, have the general appearance of aecia, especially of the heteroecious forms belonging to grass and sedge rusts. The brilliant studies of Messrs. Whetzel and Olive, however, have fully demonstrated their telial character.

85. ENDOPHYLLUM STACHYTARPHETAE (P. Henn.) Whetzel & Olive.

ON VERBENACEAE:

Valerianodes cayennensis (Vahl) Kuntze, Rio Piedras, April 11, 22, *72*.

The rust was first collected by J. R. Johnston at Rio Piedras, P. R., Feb. 2, 1913, but not determined. It is also known from St. Domingo, and occurs in South America on the same host from Colombia and Bolivia, and on *V. dichotoma* from Brazil. The last collection was made by E. Ule, no. *2163*, and is the type for the species.

86. ENDOPHYLLUM DECOLORATUM (Schw.) Whetzel & Olive (*Aecidium decoloratum* Schw.).

ON CARDUACEAE:

Clibadium erosum (Sw.) DC., El Yunque, April 15, *71*.

87. ENDOPHYLLUM WEDELIAE (Earle) Whetzel & Olive (*Aecidium Wedeliae* Earle).

ON CARDUACEAE:

Wedelia trilobata (L.) Hitchc., Mayagüez, Feb. 29, *65;* March 3, *70,* March 29, *66;* Barceloneta, April 6, *68;* Utuado, April 7, *67;* Rio Piedras, April 21, 22, *69*.

88. ENDOPHYLLOIDES PORTORICENSIS Whetzel & Olive (*Aecidium expansum* Arth., not *A. expansum* Diet.).

ON CARDUACEAE:

Mikania cordifolia (L. f.) Willd., Mayagüez, Feb. 29, March 29, *83;* Maricao, March 16, *84;* San German, April 1, *85;* El Duque, April 19, *86*.

Mikania odoratissima Urban, El Yunque, April 14, *73;* El Duque, April 19, *74*.

The material in the Stevens set was not sufficiently well studied to make out the true character of the sorus, and an erroneous determination was the consequence. The second host was not named in the Stevens list, although his no. 135, given as *Mikania* sp., has since been determined as *M. odoratissima*. The species has been found in the phanerogamic herbarium of the N. Y. Bot. Garden on *M. Stevensiana* Britton, Maricao river, P. R., Feb. 14, 1915, *Britton & Cowell 4225,* and on *M. scandens* (L.) Willd.,

Secanquim, Depart. Alta Verapaz, Guatemala, Jan. 11, 1905, *Maxon & Hay 3239*, and Aspinwall, Panama, Oct. 1859, *Sutton Hays 868*.

89. PUCCINIOSIRA PALLIDULA (Speg.) Lagerh.

ON TILIACEAE:

Triumfetta semitriloba L., Mayagüez, Feb. 29, *108*, March 1–8, *107*; Maricao, March 7, *105*; Yauco, March 31, *106*.

90. BOTRYORHIZA HIPPOCRATEAE Whetzel & Olive, Am. Jour. Bot. 4: 47. 1917.

ON HIPPOCRATEACEAE:

Hippocratea volubilis L., Mayagüez, March 1, 3, 27, *87*, March 7, *88*, March 9, *89*; Barceloneta, April 6, *90*; Rio Piedras, April 4, 21, *91*; El Yunque, April 12, *92*.

The structure of this rust is in many ways quite aberrant. No other telial form is known having a *Uredo*-like sorus. The white, conidia-like spores, produced in great abundance, remind one of certain phycomycetous fungi. The grouping of the sori on small hypertrophied areas, or uniformly over much drawn and etiolated shoots, agrees well with some rusts, *i. e.*, the short cycle *Puccinia obliqua* on asclepiads, or the aecia of *Puccinia Rivinae*. The careful and conclusive studies by Messrs. Whetzel and Olive warrant us in believing this to be a genuine rust. Its further study and the search for related forms are likely to give another, and possibly new, angle from which to interpret the evolution of the Uredinales.

Form-genus: **Aecidium**

All of the forms listed here probably belong to heteroecious species under *Aecidiaceae*. The spores of each form have been tested by the collectors and found to germinate in a moist atmosphere by the production of long hyphae without showing promycelial tendency.

91. AECIDIUM PASSIFLORIICOLA P. Henn.

ON PASSIFLORIACEAE:

Passiflora rubra L., Mayagüez, March 8, *59*; Maricao, March 16, *60*.

The germination of this rust was tested by Messrs. Whetzel and Olive in moist air on a solid substratum and found to produce the usual indeterminate hyphal growth of genuine aecia. In a number of instances they found the rust in the field so intimately associated with a telial rust on *Scleria pterota* as to strongly suggest their genetic connection.

The rust has also been found in Jamaica by L. M. Underwood, at Castleton, no. *82*, Linstead, no. *1746*, and Cockpit county, no. *3316*. It also is known from South America, having been collected in Peru by E. Ule, on *Passiflora tricuspis*, no. *3235*.

92. AECIDIUM TOURNEFORTIAE P. Henn.

ON BORAGINACEAE:

Tournefortia bicolor Sw., Barceloneta, April 8, *64*.

Tournefortia microphylla Bert., Yauco, March 30, *312*.

The two hosts listed are new for the rust. The only previous North American collections were by Prof. Stevens at two localities in Porto Rico on *T. hirsutissima*.

93. AECIDIUM TUBULOSUM Pat. & Gaill.

ON SOLANACEAE:

Solanum torvum Sw., Mayagüez, March 6, *58;* Maricao, March 15, *56;* Utuado, April 7, *57*.

Field evidence suggests the possible connection of this form with *Puccinia substriata*, no. 46.

94. AECIDIUM ABSCEDENS Arth.

ON RUBIACEAE:

Randia aculeata L., Barceloneta, April 5, 6, *61;* Campo Allegra, April 21, *62*.

95. AECIDIUM BORRERIAE Pat.

ON RUBIACEAE:

Hemidiodia ocimifolia (Willd.) K. Schum., Mayagüez, March 6, *169a*, El Yunque, April 14, *279*.

Form-genus: **Uredo**

Paraphyses imbricated to form a pseudoperidium, or with cells united into a peridial membrane, mostly forms belonging to Uredinaceae, Nos. 96 to 102.

Paraphyses absent, or if present, free and peripheral, mostly forms belonging to Aecidiaceae, Nos. 103 to 122.

96. Uredo globulosa Arth.

On Amaryllidaceae:

Hypoxis decumbens L., Maricao, March 23, *313;* Añasco, March 28, *448.*

The first collection of this species in Porto Rico was made at Rio Piedras, March 14, 1911, by J. R. Johnston.

97. Uredo Coccolobae P. Henn. Hedw. **35**: 253. 1896.

On Polygonaceae:

Coccoloba uvifera L., Mayagüez, March 3, *342;* Boqueron, March 11, *343;* San German, April 1, *344.*

The large, leathery leaves of the host are abundantly besprinkled with the punctiform sori, to some extent on both sides, but especially beneath. The fungus produces scarcely any discoloration, except to give a rusty appearance to the surface, due to the reddish-brown tissue closely surrounding the sori.

The spores are ellipsoid, 21–24 by 29–37 μ; wall 1–1.5 μ, thick, pale yellow or nearly colorless, finely and closely echinulate, pores obscure. The sorus is subepidermal, surrounded by colorless, clavate paraphyses, which are imbricated into a pseudoperidium. The sorus opens by a central pore.

This is the first collection of the species from North America. The type was on *C. populifolia* Wedd., from Brazil.

98. **Uredo notata** sp. nov.

On Malpighiaceae:

Byrsonima crassifolia H. B. K., Mayagüez, March 7, *333.*

Uredinia hypophyllous, scattered or somewhat in groups, bullate, 0.1–0.4 mm. across, fuscous, subepidermal, opening by a central pore; pseudoperidium of imbricated paraphyses, the free portion of each one cylindrical, bluntly rounded at the end, or sometimes acuminate and pointed, 9–15 μ in diameter, the free part 75–115 μ long, the wall colorless, thickened to leave the lumen scarcely visible; urediniospores ellipsoid or broadly obovoid, borne singly, 23–30 by 35–50 μ; wall golden-brown, moderately thick, 2–4 μ, sometimes thicker above, 3–7 μ, strongly and sparsely echinulate.

The spores much resemble those of *Uredo uberabensis* P. Henn., from Brazil, on some undetermined species of *Byrsonima,* but are considerably larger. The conspicuous pseudoperidium

appears to be absent from the Brazilian form, at least it is not mentioned in the original description, and could not be seen in the material at hand (*Ule, 2005*). About the same differences also maintain between the Porto Rican material and the description of the uredinia of *Cronartium Byrsonimatis* P. Henn., which was collected in Brazil by Puttemans on *Byrsonima coccolobifolia*, of which I have seen no specimen. The resemblance, however, is sufficiently good to indicate that the present form probably belongs to *Cronartium*.

99. **Uredo Trichiliae** sp. nov.

ON MELIACEAE:

Trichilia pallida Sw., Maricao, along Rio Grande, March 24, *63*.

Uredinia caulicolous, on etiolated shoots, or on midrib and veins, oblong or linear, 0.5–3.5 mm. long, numerous, subepidermal, soon naked, pulverulent, bright yellow, ruptured epidermis evident; peridium and paraphyses none; urediniospores borne singly on pedicels, obovoid or ellipsoid, small, 13–15 by 16–23 μ; wall colorless or nearly so, thin, 1–1.5 μ, closely and finely echinulate, the pores obscure.

A rust of unusual appearance, whose affinities are not evident. The form of the sorus and character of the spores suggest *Kuehneola* more than they do *Puccinia* or *Uromyces*. No pycnia or telia could be found. The effect upon the host is similar to that produced by many aecia.

100. UREDO JATROPHICOLA Arth.

ON EUPHORBIACEAE:

Jatropha gossypifolia L., Yauco, March 31, *241;* Tanamá River Valley, April 7, *240;* Rio Piedras, April 10, *239.*

The paraphyses in this species are sometimes poorly developed, and in the usual free-hand sections may appear to be and possibly are absent. Usually, however, they form a strong pseudoperidium, although individually small. In these respects they behave like the similar paraphysoid structure in the uredinia of the common Ficus rust.

101. **Uredo Clusiae** sp. nov.

ON GUTTIFERAE:

Clusia rosea Jacq., Maricao, mountains along Rio Grande, March 22, *371*.

Uredinia hypophyllous, scattered, mammilliform, 0.3–0.6 mm. across, dark brown, opening by a central pore or rupture, subepidermal, deep-seated; urediniospores obovoid or ellipsoid, 19–23 by 28–35 μ; wall light yellow, about 1.5 μ thick, sparsely and strongly echinulate, the points being 1–2 μ long and about 3 μ apart.

The large thick leaves of the host readily show the numerous sori. Sections show that the sorus is formed well down in the tissues, apparently below one or more layers of the mesophyll underneath the epidermis. It was not possible to be quite certain about a peridium, but there may be one having rhomboidal cells, that are verrucose on the inner side. The spores have a conspicuous echinulation, which with the absence of demonstrable pores and the general character of the sorus indicates a possible relationship to Cronartium.

102. UREDO BIXAE Arth.

ON BIXACEAE:

Bixa Orellana L., Maricao, March 25, *326*.

The paraphysate structure has not been well made out in the species, but appears to be an imbricated pseudoperidium.

103. UREDO GYMNOGRAMMES P. Henn.

ON POLYPODIACEAE:

Adiantum latifolium Lam., Mayagüez, March 6, *2*, March 10, *3*.

Dryopteris mollis (Jacq.) Huron, Mayagüez, March 6, *4*.

Dryopteris Poiteana (Bory) Urban, Mayagüez, March 6, *7*, March 13, *8*, March 20, *9*; Maricao, March 24, *10*.

Gomiopteris guadalupensis Fee, Mayagüez, March 3, *1*.

Pityrogramma calomelaena (L.) Link, Maricao, March 16, *5*.

Tectaria Martkniensis (Spreng.) Copel, Mayagüez, March 6, *6*.

The species is known also from Cuba and Jamaica. The first,

second and fourth hosts are now reported for the first time. It is evident that the rust may be found upon many species and genera of ferns, and is doubtless common and widespread.

104. UREDO PASPALICOLA P. Henn. (*U. Stevensiana* Arth.).

ON POACEAE:

Axonopus compressus (Sw.) Beauv., Mayagüez, March 8, *412*.

Bambos vulgaris Schrad., Maricao, March 15, *428, 429;* Mayagüez, March 20, *427*.

Paspalum conjugatum Berg., Mayagüez, Feb. 29, *413*, March 2, *410;* Maricao, March 25, *417*.

Paspalum plicatulum Michx., Añasco, March 28, *419*.

With the increase of material and more extended study given this rust since publication of *Uredo Stevensiana* (MYCOL. **7**: 326. 1915) it has been found that the presence or absence of paraphyses in the sorus is a variable character. Examined by scraped mounts paraphyses often seem absent, when careful sections show them to be present. Different sori possess paraphyses in varying number and prominence. There appear to be all gradations between non-paraphysate and conspicuously paraphysate sori. The two forms are consequently here united.

The urediniospores of this form are indistinguishable from those of *Puccinia deformata* Berk. & Curt., on *Olyra latifolia*, but the latter are usually accompanied by teliospores. Such delicate, colorless spores give few characters by which they can be separated. It seems best to maintain *Uredo paspalicola* as a distinct form until suitable teliospores are found to rightly show its affinities.

In the Stevens list (MYCOL. **8**: 21) a collection on *Oplismenus hirtellus* was referred to the South American *Uredo Olyrae* P. Henn. A more detailed study of the material has since shown that it properly belongs under *U. paspalicola*.

105. UREDO PALLIDA Diet. & Holw. Bot. Gaz. **24**: 37. 1897.

ON POACEAE:

Zea Mays L., Naguabo on slope of El Duque, April 19, *440*.

A new host for this rust, which has heretofore been known

only from Mexico and Central America and only on *Tripsacum lanceolatum* Rupr. The credit for its discovery should be given to Mr. J. A. Stevenson, who first detected it in company with Dr. Olive.

106. UREDO DICHROMENAE Arth.

ON CYPERACEAE:

Dichromena ciliata Vahl, Mayagüez, March 27, *44;* Naguabo on slope of El Duque, April 19, *46;* Rio Piedras, April 22, *45*.

Dichromena radicans Cham. & Schl., Mayagüez, March 8, *50;* Maricao, March 23, *49;* Añasco, March 28, *48;* El Yunque, April 12, *51;* Naguabo on slope of El Duque, April 19, *47*.

107. UREDO FUIRENAE P. Henn.

ON CYPERACEAE:

Fuirena umbellata Rottb., El Yunque, April 12, *28;* Naguabo along railroad, April 19, *27*.

Fuirena sp., Naguabo on slope of El Duque, April 19, *442*.

108. UREDO SUPERIOR Arth.

ON CYPERACEAE:

Fimbristylis ferruginea (L.) Vahl, Martin Peña, April 10, *23*.

Fimbristylis spadicea (L.) Vahl, Mayagüez, road to Guanajibos, March 3, *24*.

Heretofore only the type collection of this species was known. It was collected near Ponce, on *F. spadicea*, Dec. 12, 1902, by A. A. Heller *6279*. The urediniospores of this species are much larger and thicker-walled than are those of *Puccinia Fimbristylidis*.

The present collection on *F. ferruginea*, as well as the two collections previously recorded in the Stevens list, do not have urediniospores as uniformly large and thick-walled as those on *F. spadicea*, but all the material in hand shows so much greater resemblance to this species than to *P. Fimbristylidis*, that it is transferred here pending the finding of teliospores.

109. UREDO DIOSCOREAE P. Henn.

ON DIOSCOREACEAE:

Dioscorea polygonoides H. & B., El Yunque, April 12, *320.*
Rajania cordata L., Maricao, March 22, *316, 319;* Tanamá River Valley, April 7, *315;* Barceloneta, April 8, *317;* El Yunque, April 12, *318.*

The first named host is new for the rust. All the collections here listed show a uniform appearance of the uredinia and urediniospores, agreeing with those of previous Porto Rican and Cuban collections.

110. UREDO HELICONIAE Diet.

ON SCITAMINEAE:

Bihai borinquena Griggs, El Yunque, April 12, *221.*

This is the first report of the rust for Porto Rico. It was collected in 1913 by Prof. F. L. Stevens in Martinique. The host is a new one for the species.

111. UREDO GYNANDREARUM Corda.

ON ORCHIDACEAE:

Prescottia oligantha (Sw.) Lindl., Maricao, March 16, *314.*

This collection gives a new host for this rust. The rust was found on *Habenaria* sp., now determined as *H. maculosa* Lindl., at Bayamon, P. R., Jan. 11, 1899, *A. A. Heller 118.*

112. UREDO HYMENAEAE Mayor.

ON CAESALPINIACEAE:

Hymenaea Courbaril L., Fajardo, April 20, *175;* Campo Allegra, April 21, *176;* Coamo, April 23, *174;* Mayagüez, March 6, *177,* March 13, *178.*

113. UREDO LUTEA Arth.

ON CAESALPINIACEAE:

Cassia quinquangulata L. C. Rich., Maricao, March 16, *179;* El Yunque, April 14, *180.*

114. UREDO CABRERIANA Kern & Kellerm.

ON FABACEAE:

Erythrina glauca Willd., Rio Piedras, April 11, *173.*

115. UREDO SAUVAGESIAE Arth.

ON OCHNACEAE:

Sauvagesia erecta L., El Yunque, April 12, *231*.

116. UREDO CUPHEAE P. Henn.

ON LYTHRACEAE:

Cuphea Parsonsia R. Br., Mayagüez, March 7, *302;* Maricao, March 16, 23, *301;* Añasco, March 28, *300*.

117. **Uredo Operculinae** sp. nov.

ON CONVOLVULACEAE:

Operculina dissecta (Jacq.) House (*Convolvulus dissectus* Jacq.), Yauco, along railroad east, March 31, *310*.

Uredinia hypophyllous, in small crowded groups on slightly discolored spots, or scattered singly, subepidermal, bullate, opening by a small rupture of the overarching epidermis, without paraphyses or peridium; urediniospores globoid, or broadly obovoid, 14–23 by 23–29 μ; wall thin, about 1 μ, rarely a little more, finely and closely echinulate, pale brownish or nearly colorless, the pores not discernable.

The unusual form of the sorus, and the pale, thin-walled spores, distinguish this rust from previously described species on this family of hosts.

118. UREDO HAMELIAE Arth.

ON RUBIACEAE:

Hamelia erecta Jacq., Yauco, base of hills two miles east, March 31, *351*.

119. UREDO SABICEICOLA Arth.

ON RUBIACEAE:

Sabicea aspera Aubl., Mayagüez, March 1, *236*, March 10, *235;* Maricao, March 23, *237*.

120. UREDO PROXIMELLA Arth.

ON CICHORIACEAE:

Lactuca intybacea Jacq., Barceloneta, April 7, *134*.

121. UREDO PLUCHEAE Syd. (*U. biocellata* Arth.).

ON CARDUACEAE:

Pluchea purpurascens (Sw.) DC., Mayagüez, south along railroad, March 3, May 3, i, II, *156*.

Since the publication of the Porto Rican list of rusts, attention has been called to the prior publication of *Uredo Plucheae* Syd., as a name for this rust, and Dr. H. Sydow has kindly sent me a part of the type for examination.

The present collection is also accompanied by aecia, which may or may not be genetically connected with the uredinia. The aecial infection shows as purplish spots, 3–5 mm. across, with pale centers, on the under side of which only a few, small, pale aecia were found. Upon making sections the fragile peridium was disclosed, not extending above the leaf surface. The peridial cells are rhomboidal, slightly overlapping, about 15 by 26 μ, the outer wall smooth, about 3 μ thick, the inner wall verrucose, thin, about 1.5 μ thick. The aeciospores are globoid, 14–19 μ in diameter, the wall thin, 1 μ, colorless, minutely and inconspicuously verrucose.

122. UREDO SPARGANOPHORI P. Henn.

ON CARDUACEAE:

Struchium Sparganophorum (L.) Kuntze, Mayagüez, March 6, *169*, March 8, *170*, March 13, *171*, March 27, *172*.

A collection was made by J. R. Johnston at Carolina, P. R., Feb. 18, 1914, II, *1416*.

The uredinia of this form are amphigenous, with the grouping somewhat different on the two sides of the leaf. Beneath they are usually scattered, while above they form cespitosely pulvinate groups. The sorus and spores from the two sides, however, do not appear unlike.

SPECIES PREVIOUSLY REPORTED FROM PORTO RICO, NOT IN THE ABOVE LIST

123. MILESIA COLUMBIENSIS (Dietel) Arth., on *Nephrolepis rivularis* (*Polypodiaceae*), *Stevens*.

124. RAVENELIA CEBIL Speg., on *Piptadenia peregrina* (*Caesalpiniaceae*), *Stevens*.

125. RAVENELIA PORTORICENSIS Arth., on *Cassia emarginata* (*Caesalpiniaceae*) *Heller*.

126. RAVENELIA CASSIAECOLA Atks., on *Chamaecrista Aeschynomene* (*Caesalpiniaceae*), *Stevens*.

127. RAVENELIA CAULICOLA Arth., on *Cracca cinerea* (*Fabaceae*), *Stevens, Johnston & Seaver.*

128. TRANZSCHELIA PUNCTATA (Pers.) Arth., on *Amygdalus persica* (*Amygdalaceae*), *Earle.*

129. ARGOMYCES INSULANS Arth., on *Vernonia albicaulis* and *V. longifolia* (*Carduaceae*), *Stevens.*

130. UROMYCES COMMELINAE (Speg.) Cooke, on *Commelina virginica* (*Commelinaceae*), *Stevens.*

131. UROMYCES JAMAICENSIS Vesterg., on *Bauhinia pauletia* (*Fabaceae*), *Stevens, Holway.*

132. UROMYCES COLOGANIAE Arth., on *Teramnus uncinatus* (*Fabaceae*), *Holway.*

133. UROMYCES JANIPHAE (Wint.) Arth., on *Manihot Manihot* (*Euphorbiaceae*), *Stevens.*

134. UROMYCES GEMMATUS Berk. & Curt., on *Jacquemontia nodiflora* (*Convolvulaceae*), *Stevens, Holway.*

135. PUCCINIA CAMELIAE Mayor, on *Chaetochloa setosa* (*Poaceae*) *Stevens.*

136. PUCCINIA SCIRPI DC., on *Scirpus lacustris* (*Cyperaceae*), *Heller.*

137. PUCCINIA SCLERIICOLA Arth., on *Scleria* sp. (*Cyperaceae*), *Stevens.* The specimens on *S. hirtella* placed here in the Stevens list must be considered doubtful.

138. PUCCINIA MACROPODA Speg., on *Iresine elatior* (*Amarantaceae*), *Stevens.*

139. PUCCINIA EUPHORBIAE P. Henn., on *Aklema petiolaris* (*Euphorbiaceae*), *Stevens.*

140. PUCCINIA CRASSIPES Berk. & Curt., on *Ipomoea triloba* (*Convolvulaceae*), *Stevens, Johnston.*

141. PUCCINIA CORDIAE Arth., on *Cordia alliodora* (*Ehretiaceae*), *Holway.*

142. PUCCINIA XANTHII Schw., on *Xanthium longirostre* (*Ambrosiaceae*), *Britton & Cowell, Johnston.*

143. AECIDIUM FAVACEUM Arth., on *Phyllanthus nobilis* (*Euphorbiaceae*), *Stevens.*

144. UREDO VENUSTULA Arth., on *Andropogon brevifolius* (*Poaceae*), *Stevens.*

145. UREDO ANTHURII Hariot, on *Anthurium scandens* (*Araceae*), *Stevens.*

146. UREDO COMMELYNEAE Kalchbr., on *Commelina virginica* (*Commelinaceae*), *Stevens.*

147. UREDO NIGROPUNCTATA P. Henn., on *Bletia patula* (*Orchidaceae*), *Stevens.*

148. UREDO PUSTULATA P. Henn., on *Stenorrhynchus lanceolatus* (*Orchidaceae*), *Stevens.*

149. UREDO GUACAE Mayor, on *Epidendrum difforme* (*Orchidaceae*), *Stevens,* and *E. rigidum, Holway.*

150. UREDO PIPERIS P. Henn., on *Peperomia hermandifolia* (*Piperaceae*), *Stevens.*

151. UREDO ARTOCARPI B. & Br., on *Artocarpus communis* (*Artocarpaceae*), *Clinton.*

152. UREDO RUBESCENS Arth., on *Dorstenia Contrajerva* (*Artocarpaceae*), *Stevens.*

153. UREDO AESCHYNOMENIS Arth., on *Aeschynomene americana* (*Fabaceae*), *Stevens.*

154. UREDO ARACHIDIS Lagerh., on *Arachis hypogea* (*Fabaceae*), *Stevens.*

155. UREDO ERYTHROXYLONIS Graz., on *Erythroxylon areolatum* (*Erythroxylonaceae*), *Stevens.*

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INDEX TO UREDINALES

New and newly combined names are in **bold-faced** type.

Host Index

PURDUE UNIVERSITY,
LAFAYETTE, INDIANA.

TEXAS PARASITIC FUNGI

New Species and Amended Descriptions

B. C. Tharp

The new species of pathogenic fungi described in this article were among the specimens of two series of collections; the first of these having been begun in the summer of 1914 and continued to the early spring of 1915, the second beginning in May, 1915, and continuing to midsummer, 1916. The first was undertaken under the direction of Prof. I. M. Lewis, of the School of Botany, University of Texas, for the purpose of obtaining material for a graduate thesis, which was intended to supplement the work of Heald and Wolf, as published in their Plant Disease Survey in Texas (Bul. 226, Bur. Pl. Ind., Jan. 1912). Beside the Austin vicinity, collections were made at several points in east and northeast Texas.

On May 1, 1915, the writer began work in plant pathology for the Texas Department of Agriculture, and the second series of collections has been made since that time, partly by himself, both alone and in company with others, and partly by members of the field force of the Department. The place and date of collection, together with name of collector, follows the description of each of the following species. Unavoidably delayed verifications kept the first series from being fully reported in the thesis above mentioned; hence its inclusion in the present paper.

Identifications were made and descriptions written by the author, verifications of those fungi of both series belonging to the order Uredinales being kindly undertaken by Professor J. C. Arthur. Fungi in the first series of collections not belonging to the order Uredinales were submitted to Mrs. Flora W. Patterson, of the Mycological Herbarium, Washington, D. C., while the writer himself visited this herbarium in September, 1916, for the purpose of verifying the new and doubtful species in the second

series. I wish here to make grateful acknowledgment, both to Professor Arthur and to Mrs. Patterson and her associates, for their assistance to me.

The total number of host-parasite combinations resulting from these collections and previously unreported for Texas is two hundred and sixty-five, including forty-eight new species and two new varieties. There were also found to be eleven collections of fungi apparently previously described but differing from their descriptions to such an extent as to make it advisable to record the points of difference. These new species and varieties, together with those to whose descriptions amendments have been offered, are the basis for the present article.

For convenience in reference the genera have been arranged in alphabetic order, instead of following the natural grouping.

Specimens from all type collections have been deposited in the Mycological Herbarium at Washington, D. C., and duplicates from such collections in the herbarium of the University of Texas; while of the collections of the second series, type duplicates have been deposited both in the above herbaria and in the Mycological Herbarium of the Texas Department of Agriculture. Wherever the amount of material has been sufficient to warrant it, the writer has also kept specimens in his private herbarium.

Ascochyta boerhaaviae sp. nov.

Spots dirty-brownish-gray, suborbicular, 2–4 mm. in diameter; pycnidia dark-brown, epiphyllous, globose depressed, immersed, finally opening to surface through a pore, $80–120 \times 70–105\,\mu$; conidiophores not in evidence; conidia hyaline, guttulate, 1-septate, $12–14 \times 3.5–4\,\mu$, apparently filling pycnidia at maturity. (Associated occasionally with *Albugo bliti*, but apparently independently pathogenic.)

On living leaves of *Boerhaavia erecta* L., Austin, Texas, Nov. 1, 1915, *B. C. Tharp*.

Cercospora acalypharum sp. nov.

Amphigenous on gray-brown, distinctly zonate spots subcircular in outline, 2–5 mm. in diameter, or by confluence much larger in area; epiphyllous conidiophores in fascicles of 4–10, light-brown, straight, abruptly truncate, continuous or occasion-

ally faintly uniseptate, 20–55 × 4.5–5 μ; hypophyllous conidiophores differ from epiphyllous in much greater length (averaging more than twice as long), in being pluriseptic, and in being fewer fascicled and more spreading; conidia hyaline, 100–235 × 3 μ, upward attenuate, abruptly truncate at base, straight or occasionally slightly curved, faintly multiseptate.

On leaves of herbarium specimen of *Acalypha ostryaefolia* Ridd., U. of T. herbarium, collected Austin, Texas, *A. M. Ferguson,* Oct. 20, 1901, identified Jan. 8, 1916.

CERCOSPORA ALTHAEINA Sacc.

Maximum length of conidia in our material 120 μ, opposed to 60 μ in original description; 12–14-septate opposed to 2–5-septate; conidiophores averaging 50–55 × 5 μ, frequently more than 100 μ long, opposed to 40 × 5 rarely 100 μ long; subgeniculate bearing scars of conidia at geniculations (geniculation not mentioned in description).

On living leaves of *Althaea rosea* Cav., Houston, Texas, July 9, 1915, *B. C. Tharp.*

Cercospora ammanniae sp. nov.

Spots minute, 1–2 mm. in diameter, circular or subcircular, dirty-grayish-brown with purplish raised margin above, rusty-brown below, sometimes apparently confluent at tips causing death of the whole tip of leaf; conidiophores amphigenous, densely fasciculate on tuberculate base, light-brown to subhyaline, spreading, 1–3-septate, strongly geniculate, rarely branched toward tips, 40–60 × 4 μ; conidia hyaline, obclavate to attenuate, septate below, guttulate above, 60–100 × 3–4 μ, rarely longer.

On living leaves of *Ammannia coccinea* Rottb., Austin, Texas, *I. M. Lewis & B. C. Tharp.*

Cercospora apiifoliae sp. nov.

Spots amphigenous, marginal or central, brown, orbicular to irregular, 1–7 mm. in diameter, surrounded by a more or less yellow border; conidiophores principally epiphyllous, densely fascicled, surmounting a subtubercular base, olivaceous, continuous, tortulose, 20–25 × 3–4 μ; conidia light-olivaceous, faintly pluriseptate-guttulate, cylindric to spindleform, 30–50 × 3 μ.

On living leaves of *Crataegus apiifolia* Michx., Texarkana, Texas, Oct. 16, 1915, *I. M. Lewis & B. C. Tharp.*

Cercospora arboriae sp. nov.

Spots mostly central, rarely at margin of leaf, dark-brown to almost black above, more dilute-brown below, angular, 1–3 mm. in diameter, margin darker; conidiophores amphigenous but principally hypophyllous, yellowish-brown, subgeniculate, 40–60 × 4 μ, in loose fascicles surmounting a tuberculate base, ascending but spreading, not produced till spots show a grayish-brown center; conidia attenuate to obclavate, subhyaline to pale-yellow, pluriseptate, 35–85 × 3–5 μ.

On living leaves of *Ampelopsis arboria* (L.) Rusby, Austin, Texas, Oct. 20, 1914, *I. M. Lewis & B. C. Tharp.*

Cercospora bidentis sp. nov.

Spots amphigenous, 5–8 mm. or more in diameter, circular or irregular, with definite raised margin above, indefinite below; hyphae epiphyllous, fascicled 3–25 in each fascicle, brown, 50–120 × 4–5 μ, subnodulose, 2-pluriseptate; conidia 45–150 × 3–4 μ, continuous, strongly attenuate upward, strongly pluriguttulate.

On living leaves of *Bidens nashii* Small, Palestine, Texas, Oct. 30, 1914, *I. M. Lewis & B. C. Tharp.*

Cercospora bliti sp. nov.

Spots dark-brown above, lighter below, very large (occasionally as much as 2 × 3–4 cm.) or by confluence blighting whole leaflets; conidiophores amphiglious, those above 20–30 × 4 μ, light-brown, continuous, 5–15 fascicled surmounting a subimmersed dark-brown tubercle about equal in height to the length of conidiophores; hypophyllous conidiophores longer than epiphyllous (30–65 μ); subgeniculate, septate, darker brown, fewer fascicled, likewise surmounting a more or less immersed tubercle; conidia pale-yellow, pluriseptate, upward attenuate, 50–120 × 3 μ.

On living leaves of *Rubus* sp. (blackberry), Brazoria, Texas, Sept. 4, 1915, *B. C. Tharp.*

Cercospora capitati sp. nov.

Spots dirty-brown, amphigenous, irregular, 1–4 mm. in diameter, without raised margin; hyphae amphigenous, loosely few-fascicled, subnodulose, brown, 3–5 septate, 130–150 × 4–5 μ; conidia hyaline, straight or curved, attenuate upward, base truncate, faintly to clearly pluriseptate, 70–220 × 3–4 μ.

On living leaves of *Croton capitatus* Michx., Conroe, Texas, Oct. 29, 1914, *I. M. Lewis & B. C. Tharp.*

Cercospora carolinensis sp. nov.

Spots irregular, amphigenous, brown, imperfectly zonate above, 5–10 mm. or more in diameter, margin slightly raised; hyphae amphigenous, densely fasciculate, short, continuous (15–30 × 4), light-brown; conidia hyaline, 30–130 × 3–4 μ, upward attenuate, 4–7-septate.

On living leaves of *Solanum carolinense* L., Palestine, Texas, Oct. 30, 1914, *I. M. Lewis & B. C. Tharp.*

Cercospora erythrinicola sp. nov.

Spots amphigenous, circular or subcircular, 5–8 mm. in diameter, grayish-brown with darker border, brighter above than below; hyphae hypophyllous, fascicled, brown, septate, subgeniculate, slightly spreading, 40–75 × 5 μ; conidia hyaline, straight or slightly curved, subattenuate, to cylindrical, subtruncate at base, pluriseptate, 45–65 × 4–5 μ.

On living leaves of *Erythrina herbacea* L., Rockdale, Texas, Oct. 31, 1914, *B. C. Tharp.*

CERCOSPORA EUPHORBIAECOLA **tragiae** var. nov.

Spots amphigenous, grayish-brown above, water-soaked beneath, 3–8 mm. in diameter, marginal or in interior of leaf; hyphae amphigenous but chiefly hypophyllous, short, 20–30 × 4 μ, continuous, densely fasciculate, light-brown; conidia upward attenuate, hyaline or rarely light-brown toward base, 1–5 septate, 40–95 × 3 μ.

On living leaves of *Tragia nepetaefolia* Cav., Austin, Texas, Oct. 6, 1914, *I. M. Lewis & B. C. Tharp.*

Cercospora ficina sp. nov.

Spots amphigenous, mottled-rusty-brown above, bright-yellow-brown below, angular, 1–5 mm. in diameter, or greater by confluence; hyphae hypophyllous, in spreading fascicles of 10–50, brown, several times septate, subgeniculate, 75–125 × 3.5–4 μ; conidia hyaline, apparently continuous, densely granular-guttulate, gradually upward attenuate, cycle-shaped or sometimes bent almost at a right angle, 100–175 × 3 μ.

On living leaves of *Ficus carica* L., Rockdale, Texas, Oct. 31, 1914, *B. C. Tharp.*

Cercospora helenii sp. nov.

Spots white, circular or irregular, grayish-brown border, 1–2 mm. in diameter; hyphae amphigenous, brown, fasciculate, straight or subgeniculate, continuous or sparsely septate, $35–60 \times 3–4\ \mu$; conidia hyaline, granular-guttulate, cylindrical, 3–5-septate, $35–50 \times 3\ \mu$.

On living leaves of *Helenium microcephalum* DC., Austin, Texas, *I. M. Lewis & B. C. Tharp.*

Cercospora hydrangeana sp. nov.

Spots amphigenous, suborbicular, zonate, light-brown with small, white centers, 5–10 mm. in diameter, or by confluence covering large areas; conidiophores amphigenous, scattered over entire spots, but more abundant below, tufted, faintly septate, straight or rarely subdenticulate, brown at base, becoming lighter in color toward apex, $100–180 \times 4.5–5\ \mu$; conidia hyaline, straight to slightly curved, truncate at base, upward attenuate, continuous or faintly septate, $70–165 \times 3–3.5\ \mu$.

On living leaves of cultivated *Hydrangea*, Houston, Texas, June 24, 1915, *B. C. Tharp.*

CERCOSPORA ILICIS Maublanc

Spots amphigenous, marginal or central, sometimes confluent, circular to subcircular, white, surrounded by a zone of black shading through yellowish-brown to green, or sometimes without yellowish-brown zone, white center 1–3 or 4 mm. in diameter; conidiophores amphigenous, those above very short ($20–40 \times 4\ \mu$), continuous, yellowish-brown, subdenticulate, surmounting a parenchymatous and more or less cylindric brown base $20–40\ \mu$ high by $50–55\ \mu$ across, those below longer, $60–105 \times 4\ \mu$, obscurely few septate, flexuous, spreading, denticulate, surmounting a very slightly tubercular base; conidia fili-spindleform, or upward attenuate with a truncate base, at maturity multiseptate, $75–130 \times 3\ \mu$. (Described by Maublanc and Rangel in a bulletin of the state of Sao Paulo, Brazil; title *Algunos fungos do Brazil, novos ou mal conhecidos* (1); date not given.)

On living leaves of *Ilex opaca* L., Texarkana, Texas, Oct. 16, 1915, *I. M. Lewis & B. C. Tharp.*

Cercospora marrubii sp. nov.

Spots minute, circular to subcircular, white or grayish, amphigenous, without colored or raised margin; hyphae amphigenous but principally epiphyllous, brown to olivaceous, subgeniculate, pluriseptate, 100–224 × 5 μ, conidia hyaline, curved, attenuate pluriseptate, 50–150 × 3–4 μ.

On living leaves of *Marrubium vulgare* L., Austin, Texas, *I. M. Lewis & B. C. Tharp.*

Cercospora mirabilis sp. nov.

Amphigenous on circular to subcircular spots 2–5 mm. in diameter, brown and gray zonated with gray centers, brighter colored above than below; epiphyllous conidiophores in fascicles of 12–20, light-brown, subnodulose, 0–2-septate, 50–80 × 4 μ, arising from a slightly tubercular base; hypophyllous conidiophores differ from epiphyllous in being longer (averaging 100 × 4 μ) fewer fascicled (4–10), and in having a less tubercular base; conidia hyaline, faintly pluriseptate, straight to slightly curved, upward attenuate, 80–140 × 3 μ.

On living leaves of *Mirabilis jalapa* L., Austin, Texas, Oct. 30, 1915, *B. C. Tharp.*

Cercospora modiolae sp. nov.

Spots amphigenous, circular to subcircular, white centered with dark-grayish-brown, more or less angular borders shading through yellow into green, center 1–2 mm. in diameter; hyphae amphigenous, brown, geniculate, 70–110 × 5 μ, fasciculate, fascicles loose spreading; conidia straight to cycle-shaped, hyaline, usually faintly pluriseptate but occasionally markedly so, attenuate 50–140 × 5–6 μ.

On living leaves of *Modiola caroliniana* G. Don, Austin, Texas, Fall of 1914, *I. M. Lewis & B. C. Tharp.*

Cercospora nelumbonis sp. nov.

Spots few to several hundred per leaf, amphigenous, grayish-brown above with definite dark-brown border, circular to irregular, 2–7 or 8 mm. in diameter, more or less indefinite and dirty-brown below; hyphae epiphyllous, fasciculate 5–25 per fascicle, brown, 1–4-septate, subnodulose, 30–70 × 4–5 μ; conidia 25–95 × 3–4 μ, hyaline, 1–3-septate, upward attenuate.

On living leaves of *Nelumbo lutea* (Willd.) Pers., Palestine, Texas, Oct. 30, 1914, *I. M. Lewis & B. C. Tharp.*

Corcospora nigri sp. nov.

Spots amphigenous, indefinitely margined, 3–8 mm. in diameter or by confluence covering leaf, dirty-brown above, water-soaked, becoming brown beneath; hyphae amphigenous; ephiphyllous hyphae densely (30–100) fasciculate, fascicles comparatively scattered, light-brown, septate, subgeniculate, 30–50 × 5 μ, somewhat spreading; hypophyllous fascicles more densely clustered, hyphae rarely less than 50 μ long, usually longer, geniculate, septate, almost hyaline above to brown at base, spreading; conidia yellowish-gray to hyaline, cylindric or upward attenuate, 1–12-septate, 35–95 × 3–4 μ, profuse on both leaf surfaces.

On living leaves of *Solanum nigrum* L., Palestine, Texas, Oct. 30, 1914, *I. M. Lewis & B. C. Tharp.*

Cercospora nyssae sp. nov.

Spots amphigenous, circular to subcircular, 3–8 mm. in diameter, brown with a gray, punctiform center and darker brown slightly raised margin; hyphae amphigenous, short, dark-brown, continuous to once or twice septate, nodulose, spreading, 40–50 × 4–5 μ; conidia obclavate, olivaceous, 3–12-septate, 35–100 × 5–6 μ.

On living leaves of *Nyssa sylvatica* Marsh., Palestine, Texas, Oct. 30, 1914, *I. M. Lewis & B. C. Tharp.*

CERCOSPORA PERSONATA (B. & C.) E. & E.

The following quotation is taken from the Journal of Mycology 1 : 63–64.

"*Cercospora personata* (B. & C.), (*Cladosporium personatum* B. & C. Grev., III, p. 106).

"Forming small brown, orbicular spots (2–4 mm.) on the lower surface of the leaves. Hyphae densely tufted, short, brown, continuous. Conidia mostly clavate, pale brown, about 3-septate, 30–50 × 5–6 microns. Originates beneath the epidermis.

"On leaves of *Arachis hypogaea,* Carolina and Alabama (Ravenel). According to Berkeley (l. c.), 'a variety occurs

on *Cassia occidentalis* which, amongst the usual threads has others which are slender, articulated, with longer oblong 1-septate spores.'"

Our material shows conidiophores decidedly amphigenous, but much more copious below, and with attenuate, denticulate, subtortulose apices; conidia in general obclavate to cylindrical, but typically with irregular undulations and thickenings which give them quite a unique appearance. Mature conidia measure $60–130 \times 4–5\ \mu$.

It also lacks the "slender articulated threads" and the "1-septate spores" which are typical of var. *Cassia occidentalis*. General macroscopic characters are so similar, however, as to make it very likely *C. personata* (B. & C.) E. & E.

On living leaves of *Cassia occidentalis* L., Palestine, Texas, Oct. 30, 1915, *I. M. Lewis & B. C. Tharp.*

Cercospora piaropi sp. nov.

Spots ovate, grayish-tan centered with purplish-black borders somewhat raised above, brighter above than below, $1.5–3 \times 3–5$ mm. in diameter, or larger by confluence; conidiophores epiphyllous, fasciculate but very few in each fascicle, sparse, bright brown with yellowish apices, denticulate, sometimes branched, pluriseptate, $100–125 \times 3.5–4.5\ \mu$; conidia hyaline, truncate at base, upward attenuate, pluriseptate at maturity, $80–140 \times 3\ \mu$.

On living leaves of *Piaropus crassipes* (Mart.) Britton, Palestine, Texas, Oct. 30, 1914, *I. M. Lewis & B. C. Tharp.*

Cercospora populicola sp. nov.

Spots subcircular, 5–10 mm. in diameter, amphigenous, gray-brown, zonate, due to concentric zones of conidiophores; conidiophores amphigenous, concentrically zonate, brown, multiseptate, fasciculate, straight to rather subgeniculate, rarely branched, $80–114 \times 5\ \mu$; spores hyaline, slightly attenuate, multi-septate or guttulate, truncate at base, curved, $50–150 \times 2–3\ \mu$.

On living leaves of *Populus deltoides* Marsh. Associated with an undetermined species of *Volutella*. Rockdale, Texas, Oct. 31, 1914, *B. C. Tharp.*

Cercospora pulcherrimae sp. nov.

Spots amphigenous, suborbicular, centers grayish, 1–3 mm. in diameter, surrounded by a dark-brown border in turn surrounded by a borad more or less chlorotic zone which shades gradually into normal green, much brighter above than below; conidiophores amphigenous, those on upper surface densely fasciculate and clustered at centers of spots giving them a sooty appearance, brown, septate, slightly flexuous, subdenticulate, measuring up to $150 \times 4–5\ \mu$; those on lower surface few (2–8) in fascicle, and spread evenly over surface of spot, measuring up to $270 \times 4–5\ \mu$, in other respects similar to those on upper surface; conidia hyaline, multiseptate, truncate at base, attenuate, slightly curved, measuring up to $270 \times 3–4\ \mu$ (averaging $175 \times 3.5\ \mu$).

On living leaves of *Euphorbia pulcherrima* Willd., Austin, Texas, Jan. 29, 1916, *McAllister & B. C. Tharp.*

CERCOSPORA PULCHERRIMAE **minima** var. nov.

Spots very similar, except smaller, to spots described above. Microscopically it has the following differences: Epiphyllous conidiophores short ($25–45\ \mu$) rigid, truncate, hypophyllous conidiophores not exceeding $100\ \mu$ in length, denticulate many (30–40) in fascicle, semirigid, truncate; conidia never more than $170\ \mu$ long.

On living leaves of *Euphorbia pulcherrima* Willd., Victoria, Texas, Oct. 18, 1915, *H. C. Millender.*

Cercospora regalis sp. nov.

Spots amphigenous, suborbicular, brown, 1–2 cm. in diameter; conidiophores principally epiphyllous, simple, straight or curved, multiseptate, brown, paling toward the tips, reaching a maximum of $460\ \mu$ long $\times$ $5\ \mu$ in diameter; conidia hyaline, multiseptate, curved or straight, attenuate, reaching a maximum of $280 \times 4\ \mu$.

On living leaves of *Passiflora* sp., Mission, Texas, Nov. 5, 1915, *B. C. Tharp.*

Cercospora rosigena sp. nov.

Spots irregularly orbicular, 4–14 mm. (averaging 5–7 mm.) in diameter, uniformly brown, brighter above than below, margin slightly reddish above; surrounding tissue sometimes yellowish but usually not noticeably so; conidiophores amphigenous, brown, in tufts of 2–12, continuous, or occasionally 1-septate, sharply

denticulate toward apices, somewhat attenuate, $50–90 \times 4\,\mu$ (averaging $50–70 \times 4\,\mu$); conidia obclavate, olivaceous, pluriseptate, sometimes slightly curved, $45–95 \times 4–5\,\mu$ (typically $60–75 \times 5\,\mu$). (Has almost no points of similarity to *C. rosicola* Pass.)

On living leaves of *Rosa* sp., Gonzales, Texas, Sept. 29, 1916, *B. C. Tharp.*

Cercospora salviicola sp. nov.

Amphigeous on whitish centered subcircular to angular brown spots, 1–5 mm. in diameter, surrounded by a purplish zone which fades into normal green, brighter above than below; conidiophores amphigenous, tufted, 5–20 in each fascicle, brown at base shading to subhyaline at apex, or brown throughout, sub- to strongly geniculate, 1–2-septate, $30–85 \times 4\,\mu$, averaging longer below than above; conidia hyaline, pluriseptate, straight or curved, upward attenuate, abruptly truncate at base, $60–200 \times 3–5\,\mu$.

On living leaves of *Salvia farinacea* L., Austin, Texas, Oct. 27–Nov. 27, 1915, *B. C. Tharp.*

Cercospora texensis sp. nov.

Spots amphigenous, circular to subcircular, 1–6 mm. in diameter, rather bright yellow-brown, sometimes zonate above, duller brown below, surrounded by a yellow margin shading into normal green; conidiophores amphigenous, fasciculate surmounting a tubercular base, brown at base, shading through lighter brown into yellow, to subhyaline at tip, straight or slightly flexuous bear ing conidial scars, apex truncate; epiphyllous conidiophores shorter ($50–90 \times 5\,\mu$) and in denser fascicles (10–25) than the hypophyllous (2–6 in a fascicle and $100–140 \times 5\,\mu$); conidia hyaline, attenuate with truncate base, or sometimes subobclavate, multi-septate, more or less curved, at maturity measuring sometimes $200 \times 5\,\mu$.

On living leaves of *Lupinus texensis* Hook., Austin, Texas, Feb. 22, 1916; also May 19, 1916, *B. C. Tharp.*

Cercospora torae sp. nov.

Spots appearing first as dirty-yellow circular blotches 5–8 mm. in diameter, or by confluence covering entire leaflet, later having centers of smoky-brown with advancing margins of dirty-yellow; conidiophores amphigenous, fasciculate, dense on both surfaces

covering both yellow margins and brown centers, smoky-brown, pluriseptate, subtortulose, often decidedly branched, 40–90 × 5 μ; conidia yellow, obclavate to spindle form, pluriseptate strongly vacuolate 40–75 × 4.5–5 μ (usually 50–60 × 4.5–5 μ). (Clearly different from *C. nigricans* Cke. and *Ramularis cassiaecola* (E. & E.) H. & W. with the latter of which it was compared.

On living leaves of *Cassia tora* L., Palestine, Texas, Oct. 30, 1914, *I. M. Lewis & B. C. Tharp.*

Colletotrichum cinnamomi sp. nov.

Spots amphigenous, much longer than broad and running lengthways of the leaves, usually limited by main veinlets, black at first, later becoming ashen-gray with black borders above, uniformly grayish-brown below; 1–1.2 × 2–6 cm.; acervuli hypophyllous, 90–130 μ in diameter, setae abundant, dark-brown, septate, 40–60 × 3–4 μ; conidiophores hyaline, ovate 10–14 × 3–4 μ; conidia hyaline, linear-ovate, 12–16 × 3–4 μ.

On living leaves of *Cinnamomum zeylanicum* Nees, Alvin, Texas, Sept. 13, 1915, *B. C. Tharp.*

Coniothyrium rhois sp. nov.

Spots deep-brown, angular to orbicular, central or marginal, 2–10 mm. in diameter; pycnidia appearing only on older spots, hypophyllous, immersed, at length erumpent, brown, spherical to depressed globose, 70–165 μ in diameter; ostiole large (sometimes 50 μ in diameter); conidiophores obsolete; conidia at first hyaline, at maturity deep-brown, ovoid, 5–10 × 3–6 μ.

On living leaves of *Rhus virens* Lindl., Austin, Texas, Feb. 15, 1916, *B. C. Tharp.*

Coniothyrium ulmi sp. nov.

Spots amphigenous, whitish, angular, 0.5–3 mm. in diameter, profuse over entire leaf surface; pycnidia epiphyllous, subepidermal in origin, at length erumpent, black around ostiole, shading into brown below, globose, 90–125 μ in diameter; ostiole without papillae; conidiophores obsolete; conidia brown, ovate, 2–2.5 × 4–6 μ.

On living leaves of *Ulmus campestris* Smith, Bonham, Texas, Aug. 21, 1916. (Submitted for diagnosis by a nurseryman.)

Exosporium liquidambaris sp. nov.

Spots orbicular, 4–5 mm. in diameter, brown with more or less ashen centers and raised margins, contiguous tissue more or less chlorotic, often occurring at leaf edges where they are half orbicular in outline; sporodochia amphigenous, dark-brown, 20–35 μ in diameter; conidiophores very short (6–10 $\times$ 3.5 μ), continuous, compact in sporodochium; conidia pale-yellow, septate, curved, cylindric, rounded at ends, faintly pluriseptate, 30–90 $\times$ 3 μ.

On living leaves of *Liquidambar styraciflua* L., Houston, Texas, June 28, 1915, *B. C. Tharp.*

Exosporium platanorum sp. nov.

Spots few and fairly large (3–4 mm. in diameter), or many and very small (1 mm. or less), brown above, entirely covered with a black apparently waxy substance composed of sporodochia and conidia below; sporodochia dark brown at base with lighter upper portion, hypophyllous (rarely epiphyllous), 25–60 μ in diameter; conidiophores light brown, occasionally obscurely septate, subtortulose, very short (10 $\times$ 4–5 μ); conidia brown to olivaceous, curved, slightly attenuate at both ends, 3–5-septate, 34–70 $\times$ 4–5 μ.

On living leaves of *Platanus occidentalis* L., Austin, Texas, Oct. 23, 1915, *I. M. Lewis & B. C. Tharp.*

Exosporium phoradendri sp. nov.

Spots circular, 6–8 mm., showing two (usually) concentric shades of brown, margins slightly raised and yellow, alike on both leaf surfaces; acervuli amphigenous, dark-brown, 80–140 μ in diameter, formed below epidermis and rupturing it; spores yellowish, multiseptate-guttulate, 45–65 $\times$ 2 μ.

On living leaves of *Phoradendron flavescens* (Pursh) Nutt., Austin, Texas, Feb. 17, 1915, *I. M. Lewis.*

ISARIOPSIS CLAVISPORA (B. & C.) Sacc.

Our material showed conidia 30–56 $\times$ 6–8 μ, 7–8 septate, non-guttulate; opposed to 44 $\times$ 4–5 μ, 3–4-septate, guttulate, in description: Sylloge **4**: 631.

On living leaves of *Vitis* sp., Jacksonville, Texas, Oct. 15, 1915, *I. M. Lewis & B. C. Tharp.*

Napicladium prosopodium sp. nov.

Spots amphigenous, circular to orbicular, 1–2 mm. in diameter, light brown except where dense covering of conidiophores and conidia gives a dark-brown cast; conidiophores amphigenous, appearing first on upper surface, fasciculate, arising from a tubercular base which extends into subepidermal tissue, very strongly geniculate, often with very short branches at geniculations, septate, slightly spreading, typically light-brown but varying somewhat in shade of color, $20–40 \times 8–10\,\mu$; conidia light-brown when young, darker with age, spindle form, 3–8-septate, $50–80 \times 12–15\,\mu$, basal and apical cells of mature conidia noticeably lighter in color than other cells, apical cell nipple-shaped at terminal end, basal cell truncate-conic.

On living leaves of *Prosopis glandulosa* Torr., Austin, Texas, Nov. 10, 1914, *I. M. Lewis & B. C. Tharp*. Associated occasionally with *Cercospora prosopodis* H. & W., but frequently occurring alone, at which time only it produces the characteristic spots described above. The brown spots produced by *C. prosopodis* are much larger, and much lighter and duller in color than those of *N. prosopodium* and in other respects have nothing of the appearance of the spots produced by *N. prosopodium*.

Phleospora pteleae sp. nov.

Spots amphigenous usually having a punctiform, white center surrounded by a zone of dark-brown dead tissue, in turn surrounded by a conspicuous yellow zone shading into normal green, brown portions irregularly circular, 0.5–2 mm. across; pycnidia hypophyllous, $45–60\,\mu$ in diameter; spores curved, hyaline, $30–50 \times 3–4\,\mu$, 3–7-septate.

On living leaves of *Ptelea trifoliata* L., Austin, Texas, Oct. 23, 1915, *B. C. Tharp*.

Phyllachora texana sp. nov.

Stromata variable in size from minutely punctiform to more than 1 mm. in diameter, circular in outline, or by confluence irregularly lobed, typically extending through leaf and showing on both surfaces; perithecia reduced to ascigerous loculae (one or more contained in each stroma), opening through ostiola on one leaf surface only, or on both surfaces; asci paraphysate, clavate, $50–80 \times 10–14\,\mu$; spores typically 8 in each ascus, uni-

or subbiseriate, ovate, with both ends subacute, hyaline, unicellular, 12–19 × 4–5.5 μ.

On living leaves of *Acacia wrightii* Benth., Cotulla, Texas, Feb. 21, 1916, *B. C. Tharp*. Differs from *P. acaciae* P. Henn (Sylloge **11**: 368) in size of stromata, size and shape of asci, and in size of spores, though the latter point of difference is slight. The description in question, however, seems to me to be wholly too short to be satisfactory.

PHYLLOSTICTA CARYAE E. & E.

Spots brown, irregular, indefinite, shading into green, 1–5 cm. in diameter; pycnidia amphigenous, brownish black, lens-shaped, 80–140 μ in diameter; ostiola prominent, spores 7 × 3 μ, hyaline, uniguttulate.

On living leaves of *Hicoria* sp., Palestine, Texas, Oct. 30, 1914, *I. M. Lewis & B. C. Tharp*.

Phyllosticta cephalanthi sp. nov.

Spots small, 1–2 mm. in diameter, orbicular to subcircular, brown above with reddish borders, at length grayish centered, uniformly dull-brown beneath; pycnidia epiphyllous, few, produced only on gray centers of older spots, spherical, immersed, apex protruding, upper $\frac{1}{4}$ almost black, lower $\frac{3}{4}$ light-brown, 60–140 μ; conidia hyaline, strongly pluri-guttulate, 5–8 × 3–4 μ.

On living leaves of *Cephalanthus occidentalis* L., Conroe, Texas, Oct. 30, 1914, *I. M. Lewis & B. C. Tharp*. (Associated occasionally with an undetermined species of *Cercospora* (?) and with *Pestalozzia funerea* Desm.)

Phyllosticta euonymi sp. nov.

Spots marginal on leaf, whitish, indefinite in outline, fraying edge of leaves but with a purplish zone toward inner part of leaf, 3–4 × 5–10 mm. in diameter; pycnidia epiphyllous, without ostiola or ostiola minute, black, spherical, 100–150 μ in diameter; spores hyaline, elliptical, guttulate, 7–8 × 10–12 μ.

On living leaves of *Euonymus atropurpureus* Jacq., Rockdale, Texas, Oct. 31, 1914. Coll. B. C. T., Oct. 31, 1914, *B. C. Tharp*.

Phyllosticta verbenicola sp. nov.

Spots marginal or central, gray with purplish border, 2–6 mm. in diameter; pycnidia amphigenous, immersed, ostiole at length protruding, pyriform to spherical, 35–40 μ in diameter, black; spores ovate, $2.5 \times 6\,\mu$, hyaline, guttulate.

On living leaves of *Verbena bipinnatifida* Nutt., Austin, Texas, Fall of 1914, *I. M. Lewis & B. C. Tharp.*

Ramularia acalyphae sp. nov.

Amphigenous on spots which first appear on upper surface as yellowish indefinite areas 2–3 mm. in diameter, lower surface appearing faintly brownish and frosted as with powdery mildew, later the central portion becomes dead and is then surrounded by a circle of yellowish tissue, ultimate diameter of spots (in this material) being 4–5 mm.; conidiophores appearing first on under side, later also on upper, but always more copious on lower, continuous, guttulate, yellowish (almost hyaline), denticulate above, single or fasciculate, $25–50 \times 4\,\mu$; conidia pluriseptate-guttulate, yellow-hyaline, cylindric to spindle-form, $20–50 \times 3–4\,\mu$.

On living leaves of *Acalypha lindheimeri* Muell. Arg., San Antonio, Texas, Sept. 28, 1915, *B. C. Tharp.*

Ramularia salviicola sp. nov.

Spots amphigenous, irregular, tending toward orbicular, brown, inconspicuously zonate below, 1–10 mm. in diameter; conidiophores principally hypophyllous, rather sparse, tufted, few in each tuft, hyaline to light-yellow, continuous, 20–30 μ long, obclavate, 4 μ thick at base, 2 μ at apex, apex truncate, with an apical pore; conidia spindleform, septate, hyaline to light-yellow, $30–120 \times 4–5\,\mu$, averaging about $35–40 \times 4–5\,\mu$.

On living leaves of *Salvia farinacea* Benth., Austin, Texas, Oct. 23, 1915, *B. C. Tharp.*

Ramularia saururi (E. & E.)

Described in Journal of Mycology 3: 14 as *Cercospora saururi* E. & E., but the conidia being unquestionably catenulate in our material places the species in the genus *Ramularia.*

On living leaves of *Saururus cernuus* L., Jacksonville, Texas, Oct. 15, 1915, *I. M. Lewis & B. C. Tharp.*

SEPTORIA AMBROSIAECOLA Speg.

Spots white above, light-tan below, bordered by a narrow margin of tan-brown, 0.5–2 mm. in diameter, angular to suborbicular; pycnidia epiphyllous, immersed, 1–few on each spot, spherical to depressed globose, or occasionally pseudo-confluent and lobed, 95–180 μ in diameter, opening by an irregular cleft; conidia hyaline, undulate, 40–60 $\times$ 1.5–2 μ.

On living leaves of *Ambrosia aptera* DC., Austin, Texas, June 17, 1916, *McAllister & B. C. Tharp*. Differs from description (Sylloge **22**: 1108) principally in the following points as there stated: pycnidia 90–100 μ in diameter, sub-lenticular; conidia 50–100 $\times$ 1.5–2 μ.

SEPTORIA ANEMONES Desm.

Spots usually marginal, suborbicular, 3–6 mm. or more in diameter, almost uniformly tan above except where pycnidia give centers a mottled black and tan appearance, sometimes surrounded by reddish-purple borders; tan below with dirty-blackish centers; pycnidia amphigenous but more plentiful above, where they are densely gregarious, immersed in host tissue, spherical, black, membranous, 55–100 μ in diameter, ostiole rarely forming a protrusion; conidia straight or slightly curved, guttulate, 15–40 $\times$ 1.5 μ.

On living leaves of *Anemone caroliniana* Walt., Austin, Texas, March 5, 1916, *B. C. Tharp*. Differs from *S. anemones* Desm.—so far as his description goes—in pycnidia of our material being amphigenous, and in size of sporulae in his description being only 20–22 $\times$ 1–1.5 μ.

Septoria angularis sp. nov.

Spots angular, bounded by veinlets in early stages, but later by confluence covering large areas, brown, changing abruptly into normal green at margins; pycnidia epiphyllous, light-brown, scattered, pyriform, 75–80 $\times$ 100–120 μ; immersed in tissues but erumpent through a black-necked ostiole; conidia usually curved, hyaline-yellow, guttulate, 35–50 $\times$ 3 μ.

On living leaves of *Aster drummondii* Lindl., Austin, Texas, Jan. 15, 1916, *B. C. Tharp*. Differs from *S. astericola* E. & E., *S. atropurpurea* Pk., and *S. punicei* Pk. in both gross and microscopic characters.

Septoria antirrhinorum sp. nov.

Spots 1–2.5 mm. in diameter, usually circular, sometimes irregular, light-tan above and below, margins slightly raised; pycnidia black, usually epiphyllous but sometimes hypophyllous, gregarious at centers of older spots where they are clearly visible to the naked eye, subimmersed, depressed globose, 60–120 μ in diameter; conidia hyaline, slightly curved, aseptate, 20–30 $\times$ 1.5 μ.

On living leaves of *Antirrhinum antirrhiniflorum* (Poir.) Small, Austin, Texas, Oct. 10, 1915, *B. C. Tharp.*

Septoria argemones sp. nov.

Spots amphigenous, circular, almost black, 3–8 mm. in diameter; pycnidia epiphyllous, scattered, immersed, black, spherical to subovate, 60–80 μ; conidia hyaline, curved, continuous, 18–23 $\times$ 1.5 μ.

On living leaves of *Argemone platyceras* Link & Otto, Milano, Texas, June 10, 1916, *B. C. Tharp.* Causes a definite and often serious leaf-spot, resulting in partial defoliation.

Septoria asterina sp. nov.

Spots purplish-black, at length with grayish-brown centers above, rusty-brown below, 1–5 mm. or by confluence covering the whole leaf; pycnidia pyriform, 130–200 $\times$ 110–175 μ extending through leaf, bases hypophyllous ostiola epiphyllous, spores filiform, undulate, faintly pluriseptate, 100–120 $\times$ 2.5 μ.

On living leaves of *Aster drummondii* Lindl., Austin, Texas, Fall of 1914, *I. M. Lewis & B. C. Tharp.*

SEPTORIA CERCOSPOROIDES Trail.

Spots at first show as mottled brown splotches 0.5–1 cm. or more in diameter, brighter above than below, at length uniformly brownish-black on both surfaces, but much more noticeable above, surrounded by a more or less chlorotic zone, or by confluence killing whole leaves; pycnidia amphigenous, scattered thickly over entire surface of spots, spherical, membranous, very light brown, 140–230 μ in diameter; conidia hyaline, pluriseptate-guttulate, cylindric to obclavate, 60–80 $\times$ 3 μ. Description in Grev. **15**: 109 gives pycnidia gregarious; elipsoid, 90 $\times$ 70 μ; sporules 50–60 $\times$ 2 μ.

On living leaves of large cultivated *Chrysanthemum,* Denison, Texas, Nov. 15, 1915, *B. C. Tharp.*

Septoria hicoriae sp. nov.

Spots amphigenous, irregular to subcircular, 3–10 mm. in diameter, grayish-brown with darker brown border above, sooty-brown below; pycnidia immersed before maturity, at maturity rupturing epidermis, dark-brown, spherical or at maturity twice as wide as deep, 50–125 μ in diameter, ostiola widely gaping in mature pycnidia; spores filiform, hyaline, guttulate or septate-guttulate, curved, 35–50 $\times$ 2 μ.

On living leaves of *Hicoria* sp. undetermined, and upon *H. cordiformis* Britton, Conroe and Palestine, Texas, *I. M. Lewis & B. C. Tharp.*

SEPTORIA LEPIDIICOLA E. & M.

Spots 1–6 mm. or by confluence much larger; pycnidia epiphyllous, more or less concentrically arranged, 65–140 μ in diameter.

Description of E. & M. (Sylloge III: 519 and Journal of Mycology, III: 63) very short; gives size of spots as $\frac{3}{4}$ mm. in diameter; pycnidia aggregated, 74 μ in diameter, not stating whether epiphyllous or not.

On living leaves of *Lepidium apetalum* Willd., Austin, Texas, May 22, 1916, *B. C. Tharp.*

Septoria urticaria sp. nov.

Spots amphigenous, dirty-grayish-brown with punctiform whitish centers and more or less purplish margins above, uniformly dirty-grayish-brown and less conspicuous below, scattered over entire leaf surface, in extreme cases causing intervening tissue to become chlorotic and leaves to die and fall; pycnidia amphigenous, but principally hypophyllous, uniformly dull-brown, semi-immersed, globose, 50-125 μ in diameter, ostiola wide; conidia hyaline, continuous, curved, cylindric, 50–70 $\times$ 2 μ.

On living leaves of *Urtica chamaedryoides* Pursh, Austin, Texas, Feb. 22, 1916, *B. C. Tharp.*

Septoria wistariae sp. nov.

Spots in form of blotches 2–6 mm. in diameter, or sometimes confluent, yellowish-brown above and below, with punctiform black papules marking location of pycnidia above; pycnidia epiphyllous, immersed, extending through palisade parenchyma, spherical, 90–110 μ in diameter, dark-brown; conidia hyaline, slightly curved, septate, 45–65 $\times$ 2 μ.

On living leaves of *Wistaria chinensis* DC., Algoa, Texas, June 25, 1915, *H. C. Millender.*

UNCINULA PROSOPODIS Speg. Mus. Nac. Buenos Aires 324. 1909.

Our material differs from the description cited principally in the following points; the perithecia are subglobose to rounded-lenticular, 180–205 μ in diameter, averaging 200 μ; appendages are approximately three-fourths as long as diameter of perithecia (140–165 $\times$ 4–5 μ); asci are numerous (18–40) and are 47–70 $\times$ 23–30 μ (averaging 60 $\times$ 25) and normally contain two, rarely three, spores each; spores are ovate 23–26 $\times$ 12–15 μ, and show no traces of guttulae. (Our material seems a little young, however, as evidenced by the contents of the asci not having all been absorbed by the spores.)

On living leaves of *Prosopis glandulosa* Torr., Austin, Texas, Nov. 20, 1915, *I. M. Lewis & B. C. Tharp.*

STATE DEPARTMENT OF AGRICULTURE,
AUSTIN, TEXAS.

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THREE DOLLARS A YEAR

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MYCOLOGIA

VOL. IX MAY, 1917 No. 3

MONTANA FOREST TREE FUNGI—I. POLYPORACEAE

JAMES R. WEIR

(WITH PLATE 6)

Since September, 1911, the writer has been collecting the forest tree fungi of Montana with the view of issuing a list covering all species of importance found in the state. Each year's collecting has resulted in finding such a large number of species that it seems advisable to issue a first report confined to the Polyporaceae.

The forest tree fungi of Montana are not very well known. The earlier collectors paid little attention to this particular class of plants. A few of the most important publications dealing with Montana fungi may be enumerated. A list of fungi published by Seymour[1] contains 52 species from Montana. Of these 8 were fungi of forest trees. Kelsey[2] collecting in the vicinity of Helena published a list of 74 species, of which about 14 are found on leaves or twigs of forest trees. The same author[3] published notes on nine species of Erysipheae of which 3 are on forest trees. Anderson[4] published a series of papers on the fungi of Montana

[1] List of Fungi Collected in 1884 along the Northern Pacific Railroad Proc. Boston Soc. Nat. Hist. **24**: 182–191. 1889.

[2] Notes on the Fungi of Helena, Mont. Jour. Mycol. **5**: 80–82. 1899.

[3] Study of Montana Erysipheae. Bot. Gaz. **13**: 285–288. 1889.

[4] Brief Notes on a Few Common Fungi of Montana. Jour. Mycol. **5**: 30–32. 1889.

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A Preliminary List of the Erysipheae of Montana. Jour. Mycol. **5**: 188–194. 1889.

A New Fomes from Northern Montana. Bot. Gaz. **16**: 114. 1891.

[MYCOLOGIA for March (**9**: 53–128) was issued March 22, 1917.]

in which 80 species are menioned, of which number about 13 are fungi of forest trees. Short papers by Ellis and Anderson,[5] Ellis and Everhart,[6] and Ellis and Galloway[7] mention 25 species from Montana, of which about 3 are on stems of shrubs or trees. Griffiths[8] in a series of publications on western fungi in which a number of species are either listed or described from Montana mentions 3 species (Erysiphaceae) on forest trees. Jones[9] enumerates over 100 species of fungi from the Flathead Lake region. Of this number, 17 are important forest tree fungi. Mention of many species may be found in the periodical literature treating certain groups and in the exsiccati. Century 44 (Montana edition) of Fungi Columbiani contains 15 species found on forest trees.

The present list contains a fairly large number of species, but it is not supposed that all the polypores of the state are yet collected. Members of the genus *Poria* and of the genus *Merulius* especially have been collected in abundance but only the species of which the identity is reasonably certain are listed at this time. Owing to the wide extension of the State of Montana to the east and west of the Continental Divide, its fungous flora embraces many species of the central as well as of the Pacific Coast states. The heavily wooded section in the northwestern part has practically the same fungous flora as British Columbia. In the plains region and dry mountain areas of the southern and eastern parts of the state, one may expect to find many of the species of the states to the south.

5 New Species of Montana Fungi. Bot. Gaz. **16**: 45–49, *pl. 7;* 85–86. *pl. 10.* 1891.

6 Notes on a Species of Coprinus from Montana. The Microscope **10**: 129–131. *pl. 4.* 1890.

7 New Western Fungi. Jour. Mycol. **5**: 65–68. 1889.

8 Some Northwestern Erysiphaceae. Bul. Torrey Bot. Club **26**: 138–144. 1899.

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The North American Sordariaceae. Mem. Torrey Bot. Club **11**: 1–134, *6 fig., 19 pl.* 1901.

Concerning Some West American Fungi. Bul. Torrey Bot. Club **29**: 290–301, 10 fig., 1902; **31**: 83–88, 17 fig., 1904; **34**: 207–211. 1907.

9 Montana Botany Notes. Bul. Univ. of Montana No. 61, pp. 61–65. 1910.

Specimens of most of the species listed here have been carefully checked with authentic material collected by the writer in various parts of the United States and Europe. Specimens in some of the well known exsiccati in the writer's possession have been used in checking doubtful collections. Some authentic material for comparison has been generously contributed by Dr. C. H. Kauffman, Dr. H. D. House, Dr. L. H. Pennington, and Dr. J. F. Brenckle. To these gentlemen thanks are due. The authorities for the names of the plants are with a few exceptions those responsible for the specific names only. The writer desires to express his obligations to Mr. C. G. Lloyd for verifying and determining some of the more difficult species in this list. All specimens named in this list were collected and named by the writer unless otherwise indicated and are preserved in the Laboratory of Forest Pathology, at Missoula, Montana.

POLYPORACEAE

MERULIUS

Merulius aureus Fr. on *Pinus monticola;* Heron, *Larix occidentalis,* Missoula.

Merulius corium (Pers.) Fr. on *Larix occidentalis,* Evaro, *Prunus demissa,* Missoula.

Merulius lacrymans Schum. on mine timbers (*Pinus contorta*), Butte, mill yard timbers of *Pseudotsuga taxifolia,* Libby. This fungus or its wild form (*Merulius silvester*) is found rarely on decaying logs in the forest.

Merulius molluscus Fr. on *Pinus contorta,* Anaconda, *Pinus monticola,* Troy.

Merulius niveus Fr. on *Alnus tenuifolia,* Missoula, *Betula occidentalis,* Evaro, *Abies grandis,* Libby.

Merulius squalidus Fr. on *Pinus monticola,* Libby, *Picea Engelmanni,* Darby.

Merulius tremellosus Schrad. on *Betula occidentalis,* Missoula, *Pinus ponderosa,* Evaro, greenhouse timbers, Missoula.

POLYPORUS

Polyporus adustus Willd. on *Populus trichocarpa* and *P. tremuloides,* Miscoula. Common.

Polyporus albellus Peck on *Populus trichocarpa,* Darby, *P. tremuloides,* Missoula, *Betula occidentalis,* Missoula.

Polyporus amorphus Fr. on *Pinus ponderosa,* Darby, *P. contorta,* Haugan, *P. monticola,* Troy, *Picea Engelmanni,* DeBorgia, *Abies grandis,* Thompson Falls.

Polyporus alboluteus Ellis on *Picea Engelmanni,* Taft, *Laris occidentalis,* Libby, *L. Lyallii,* Hamilton, *Abies grandis,* Evaro.

Polyporus anceps Peck on *Larix occidentalis,* Evaro, *Pinus ponderosa,* Missoula.

Polyporus arcularius Batsch on *Alnus tenuifolia,* Missoula.

Polyporus aurantiacus Peck on *Pseudotsuga taxifolia,* Troy, *Abies grandis,* Darby, *Picea Engelmanni,* Sylvanite.

Polyporus benzoinus Fr. on *Tsuga heterophylla,* Taft, *Pseudotsuga taxifolia,* Darby, *Abies grandis,* Heron, *Picea Engelmanni,* Libby.

Polyporus berkeleyi Fr. on *Larix occidentalis,* Libby. It sometimes attacks the roots of living trees.

Polyporus betulinus Bull. on *Betula occidentalis,* Troy.

Polyporus borealis Fr. on *Picea Engelmanni,* Troy, *Tsuga heterophylla,* Troy, *Abies grandis,* Evaro. It is sometimes found on dead roots of living trees.

Polyporus brumalis Pers. on *Populus trichocarpa,* Darby, *Acer glabrum,* Troy.

Polyporus caesius Schrad. on *Populus trichocarpa,* Anaconda, *Salix* sp., Libby.

Polyporus cerifluus Berk. on *Populus trichocarpa,* Troy.

Polyporus chioneus Fr. on *Thuja plicata,* Darby, *Abies grandis,* DeBorgia.

Polyporus cinnabarinus Jacq. on *Betula occidentalis,* Troy, *Populus trichocarpa,* Missoula, *P. tremuloides,* Neihart. Common throughout.

Polyporus crispellus Peck on *Populus trichocarpa,* Missoula.

Polyporus crispus Pers. on *Populus tremuloides,* Libby.

Polyporus cryptopus Ellis, at base of dead *Pinus contorta,* slightly attached to the bark, Bozeman. This species is usually found on grass roots.

Polyporus dichrous Fr. on *Thuja plicata,* Troy, *Populus trichocarpa,* Missoula, *P. tremuloides,* Monarch.

Polyporus elegans Bull. on *Amelanchier alnifolia,* LoLo, *Populus tremuloides,* Neihart.

Polyporus ellisianus Murrill on *Pinus ponderosa,* Hamilton, *P. contorta,* Troy.

Polyporus floridanus Quél. on *Acer glabrum,* Evaro.

Polyporus fragilis Fr. on *Pinus monticola,* Troy.

Polyporus frondosus Fr. about roots of *Pinus ponderosa,* Missoula, *Pseudotsuga taxifolia,* Troy.

Polyporus fumosus Pers. on *Populus trichocarpa,* Missoula, *P. tremuloides,* Sioux National Forest.

Polyporus gilvus Schw. on dead stump of *Alnus trifolia,* Somers.

Polyporus glomeratus Peck on *Betula occidentalis,* Libby.

Polyporus griseus Peck on decaying trunk of *Pinus monticola,* Libby; usually found growing in the forest mould.

Polyporus leporinus Fr. on *Pinus monticola,* Libby.

Polyporus leucospongia Ck. on *Pinus contorta,* Anaconda, *Abies lasiocarpa,* Hamilton, *Larix Lyalli,* Hamilton.

Polyporus lucidus Leysser on *Pseudotsuga taxifolia,* DeBrogia.

Polyporus mollis Pers. on *Larix occidentalis,* Libby, *Abies grandis,* Evaro, *Pinus contorta,* Troy.

Polyporus osseus Kalch. on *Betula occidentalis,* Missoula.

Polyporus perennis Linn. on damp mossy ground in thick woods, Belton, Troy, and LoLo; sometimes on decaying logs.

Polyporus picipes Fr. on *Populus trichocarpa,* Missoula, *P. tremuloides,* Neihart. Common throughout.

Polyporus pubescens Fr. on *Betula occidentalis,* Darby, *Alnus tenuifolia,* Missoula, *Salix* sp., Belton. Thin forms are sometimes referred to *P. velutinus* Fr. The form of this plant known as *P. Grayii* (*P. pubescens* var. *Grayii*) is commonly associated with the type.

Polyporus radiatus Schw. on *Alnus tenuifolia,* Libby.

Polyporus rheades Pers. on *Populus tremuloides,* Libby, growing from wound in living tree.

Polyporus sartwellii Berk. on *Betula occidentalis,* Libby. This is really an abnormal form of *Polystictus hirsutus.*

Polyporus schweinitzii Fr. on *Pinus ponderosa,* at Missoula, Ashland, and Troy, *P. monticola,* Troy, *P. contorta,* Haugan, *Larix occidentalis,* Missoula and Somers, *Picea Engelmanni* at Darby, Saltese. Causes a serious root and trunk rot in living trees.

Polyporus semisupinus Berk. on *Alnus tenuifolia,* Heron.

Polyporus spumeus Sow. on *Populus trichocarpa,* Libby and Missoula. Causes a heart rot in living trees.

Polyporus stipticus Pers. on *Pinus monticola,* Sylvanite, *Pseudotsuga taxifolia,* Saltese.

Polyporus sulphureus Fr. on *Pinus ponderosa,* Libby, *Pseudotsuga taxifolia,* Darby, *Larix occidentalis,* White Fish. Fairly common. Occasionally attacks the roots of living trees.

Polyporus umbellatus Viviani. At base of *Picea Engelmanni,* Libby.

Polyporus undosus Peck on *Abies grandis,* Darby.

Polyporus volvatus Peck on *Pinus ponderosa,* Missoula, *P. contorta,* Bozeman, *Abies grandis,* Evaro, *Picea Englemanni,* Troy.

PORIA

Poria attenuata Peck on *Pinus contorta,* Sioux National Forest, *P. monticola,* Libby, *Larix occidentalis,* Thompson Falls.

Poria aurantiaca Rost. (*P. aurea* Peck) on *Pinus monticola,* Libby.

Poria callosa Fr., resupinate form of *Trametes serialis, Pinus ponderosa,* Florence, *P. contorta,* Libby.

Poria carbonaria B. & C. on *Pseudotsuga taxifolia,* Evaro, *Pinus contorta,* Anaconda. Apparently always on burned trunks.

Poria contigua Pers. on *Thuja plicata,* Libby.

Poria corticola Fr. on bark and wood of *Populus trichocarpa,* Missoula, *P. tremuloides,* Anaconda.

Poria fulvida Ellis on *Betula occidentalis,* Bearmouth.

Poria homaema Berk. on *Picea Engelmanni,* Evaro.

Poria laminata Murrill on *Alnus tenuifolia,* Libby. Forms extensive patches 2 to 3 feet long with a conspicuous stratose pore structure.

Poria marginella, Peck on *Picea Engelmanni,* Thompson Falls, *Pinus contorta,* Anaconda.

Poria medulla-panis (Pers.) Fr. on *Pinus monticola,* Libby, *Pseudotsuga taxifolia,* Evaro.

Poria obducens Pers. on *Picea Engelmanni,* Darby.

Poria pereffusa Murrill on *Picea Engelmanni,* Troy. This is a doubtful determination but conforms to description with the exception of the host.

Poria pulchella Schw. on *Pinus ponderosa,* Missoula, *Acer negundo,* Sioux National Forest.

Poria punctata Fr. on *Betula occidentalis,* Troy and Missoula. Common.

Poria rufa Schrad. on *Pinus monticola,* Sylvanite, *P. contorta,* Boulder. Observed frequently in wide checks of fire-killed trees.

Poria sanguinolenta Schw. on *Pinus monticola,* Libby. Occasionally found in old branch knots on living trees.

Poria semisupina Berk., resupinate form of *Polyporus semisupinus* Berk., on *Alnus tenuifolia,* Evaro, *Acer glabrum,* Libby.

Poria subacida Peck on *Picea engelmanni,* Troy, *Abies grandis,* Darby, *Larix occidentalis,* Libby.

Poria subspadicea Fr. on *Pseudotsuga taxifolia,* Troy, *Pinus ponderosa,* Haugan.

Poria undata Pers. on *Abies grandis,* Darby, *Pinus contorta,* Haugan.

Poria vaporaria Pers. on *Abies grandis,* Darby.

Poria violacea Fr.. on *Pinus ponderosa,* Evaro, *Picea Engelmanni,* Libby.

Poria weirii Murrill on *Thuja plicata,* Darby, Troy, and Libby.

Poria xantha Fr. on *Pinus monticola,* Libby.

POLYSTICTUS

Polystictus abietinus Dicks. on fallen timber of all coniferous species. Sometimes found growing in wounds of living trees. Common.

Polystictus biformis Klotsch on *Populus trichocarpa,* Bearmouth, *Alnus tenuifolia,* Saltese.

Polystictus conchifer Schw. on *Ulmus Americana,* Arden.

Polystictus hirsutus Fr. on dead wood of deciduous trees and shrubs; wide range of hosts. Sometimes found on coniferous wood.

Polystictus pargamenus Fr. on *Populus trichocarpa,* Ashland, growing in wounds of living tree, on *P. tricocarpa,* Wisdom, *Salix lasiandra,* Belton. New range for this species, but the specimens are in every way typical.

Polystictus Sequoiae Copeland on *Thuja plicata,* Darby.

Polystictus versicolor Fr. on all species of hard woods throughout, occasionally on coniferous wood. The plants known as *Polystictus hirsutulus* Schw. and *P. zonatus* Fr. are also found occasionally.

FOMES

Fomes annosus Fr. on *Pinus monticola,* Trout Creek, *P. ponderosa,* Libby, *P. contorta,* Sylvanite, *Larix occidentalis,* Libby, *Populus trichocarpa,* Troy. Parasitic on the roots of living trees and continues to live after the death of the host.

Fomes applanatus Pers. The typical European form with brown soft crust on *Populus tremuloides,* DeBorgia. *Fomes leucophaeus* Mont., the typical American form with a pale or white hard crust, is very abundant and has been collected on *Populus trichocarpa* and *P. tremuloides* throughout the range

of these trees in the state. The fungus also occurs on *Populus angustifolia,* Sioux National Forest, *P. deltoides,* Missoula, *P. balsamifera,* Bearmouth, *Betula occidentalis,* Libby, *Abies grandis,* Taft, *Pseudotsuga taxifolia,* Darby. The fungus is frequently found on dead roots of living deciduous trees.

Fomes conchatus Pers. on *Betula occidentalis,* Somers, *Salix bebbiana,* Florence, *Populus trichocarpa,* Troy. The form *Fomes salicinus* Bull. is occasionally found on *Salix* species.

Fomes ellisianus Anderson on living *Shepherdia,* Sioux National Forest. Common.

Fomes everhartii Ellis on living trunks of *Populus trichocarpa,* Troy.

Fomes fomentarius Linn. on *Betula occidentalis,* Troy, *Populus trichocarpa,* Neihart, *P. tremuloides,* Missoula. The form sometimes distinguished as *Fomes lobatus* Schw. occurs.

Fomes fraxinophilus Peck on *Fraxinus* sp., Sioux National Forest, on roots of living trees.

Fomes igniarius Linn. on *Betula occidentalis,* Missoula, *Alnus tenuifolia,* Missoula, *Prunus emarginata,* Somers, *P. demissa,* Bearmouth, *Acer glabrum,* Libby, *Populus tremuloides,* Monarch, *P. angustifolia,* Glendive, *P. trichocarpa,* Troy. The fungus causes a serious heart rot in the living tree and continues alive after the death of the host.[10] The form "*nigricans*" is occasionally found.

Fomes juniperinus Schrenk. One specimen on living *Juniperus communis* may be referred to this species, Madison National Forest.

Fomes officinalis Fr. on *Larix occidentalis,* Kalispell and Missoula, *Pinus ponderosa,* Missoula and Evaro, *Pseudotsuga taxifolia,* Missoula. Causes a serious heart rot in the living tree and remains living after the death of the host, often fruiting in Poria-like form.

Fomes pini (Brot.) Lloyd on *Pinus ponderosa,* Neihart, *P. contorta,* Anaconda, *P. flexilis,* Anaconda, *P. albicatus,* Hamilton, *P. monticola,* Troy, *Picea Engelmanni,* Saltese, *Abies grandis,* Troy, *A. lasiocarpa,* Libby, *Larix occidentalis,* Missoula, *Pseudotsuga taxifolia,* Missoula, *Tsuga heterophylla,* Troy, *Thuja plicata,* Libby. *F. pini* causes a serious heart rot in the living tree and remains living after the death of the host. *Trametes Abietis* Karst. and *T. piceina* Peck are thin forms and from observations of the same plants during different seasons have perennial sporophores which may be stratified at point of attachment and should be here referred. All forms show great variation in pores, produce the same rot, and may be resupinate. *F. pini* sometimes occurs in entirely resupinate form. In this region the thin forms are not any more common on spruce than on other conifers. A plant repeatedly collected in Montana and throughout the Northwest and which occurs only on Crataegus has been reported as belonging in this group.[11] Recently specimens were sent to Lloyd who transmitted the following note to the writer: "*Trametes piceana.* On Crataegus. This species is common on

[10] Hartig. Zersetzungserscheinungen p. 115. 1878.

Spaulding. Bureau of Plant Industry Bul. **147**: 31. 1909; and in Science **28**: 816. 1908.

[11] Weir, J. R. Notes on Wood-destroying Fungi Which Grow on Both Coniferous and Deciduous Trees.—I. Phytopathology 4: 272. 1914.

acerous wood but unrecorded on frondose. Exactly same as acerous form (form with small pores). Spores globose, 5–6 mic, hyaline, transparent, often guttulate. Setae are rare but large and same as those on acerous wood. (Cfr. Syn. Fomes, p. 277.)"

Fomes pinicola Swartz. on *Larix occidentalis,* Missoula, *L. Lyallii,* Hamilton, *Tsuga heterophylla,* Troy, *Picea Engelmanni,* Libby, *Pseudotsuga taxifolia,* Missoula, *Abies grandis,* Darby, *A. lasiocarpa,* Libby, *Pinus ponderosa,* Evaro, *P. contorta,* Anaconda, *P. albicaulis,* Hamilton, *P. flexilis,* Anaconda, *P. monticola,* Troy, *Betula occidentalis,* Troy, *Alnus tenuifolia,* Libby. Occasionally causes a heart rot in the living tree, ordinarily on fallen timber.

Fomes pomaceus Pers. on *Prunus Virginiana,* Troy, *P. emarginata,* Somers, on domestic plums, Missoula. Causes a decay of the heartwood in living trees. Remains living after the death of the host.

Fomes putearius Weir on *Larix occidentalis,* Troy, *Picea Engelmanni,* Libby. A resupinate form also occurs.

Fomes ribis Schum. on living *Lonicera involucrata,* Libby, *Symphoricarpos racemosus,* Billings. The writer's specimens of *Fomes Lonicera* Weinm. and *F. Evonymi* Kalch. collected in Europe can not be distinguished in their microscopic details from *F. ribis* and should be here referred. Brenckle reports *F. ribis* as common on *Symphoricarpos* in the Dakotas.

Fomes roseus A. & S. on *Pseudotsuga taxifolia,* Darby, *Pinus contorta,* Boulder, *Picea Engelmanni,* Libby.

Fomes scutellatus Schw. on *Amelanchier alnifolia,* Libby.

TRAMETES

Trametes carnea Nees on *Pseudotsuga taxifolia,* Missoula, *Tsuga heterophylla,* Troy and Boulder, *Pinus ponderosa,* Ashland. Sporophores sometimes remain living for more than one season and are then indistinctly stratified but are quite distinct from *Fomes roseus.* A specimen on *Pinus monticola,* Troy, has a surface of whitish appressed fibrils. This form has been distinguished by the name *Trametes arctica* Berk. (See Lloyd's Synopsis of the Genus Fomes, page 225.)

Trametes hispida Bagl. on *Populus* and *Salix* spp. throughout the state. These specimens are in every way identical with material collected by the writer on *Fraxinus* in Bavaria. A form with small pores common in Europe is also occasionally found here.

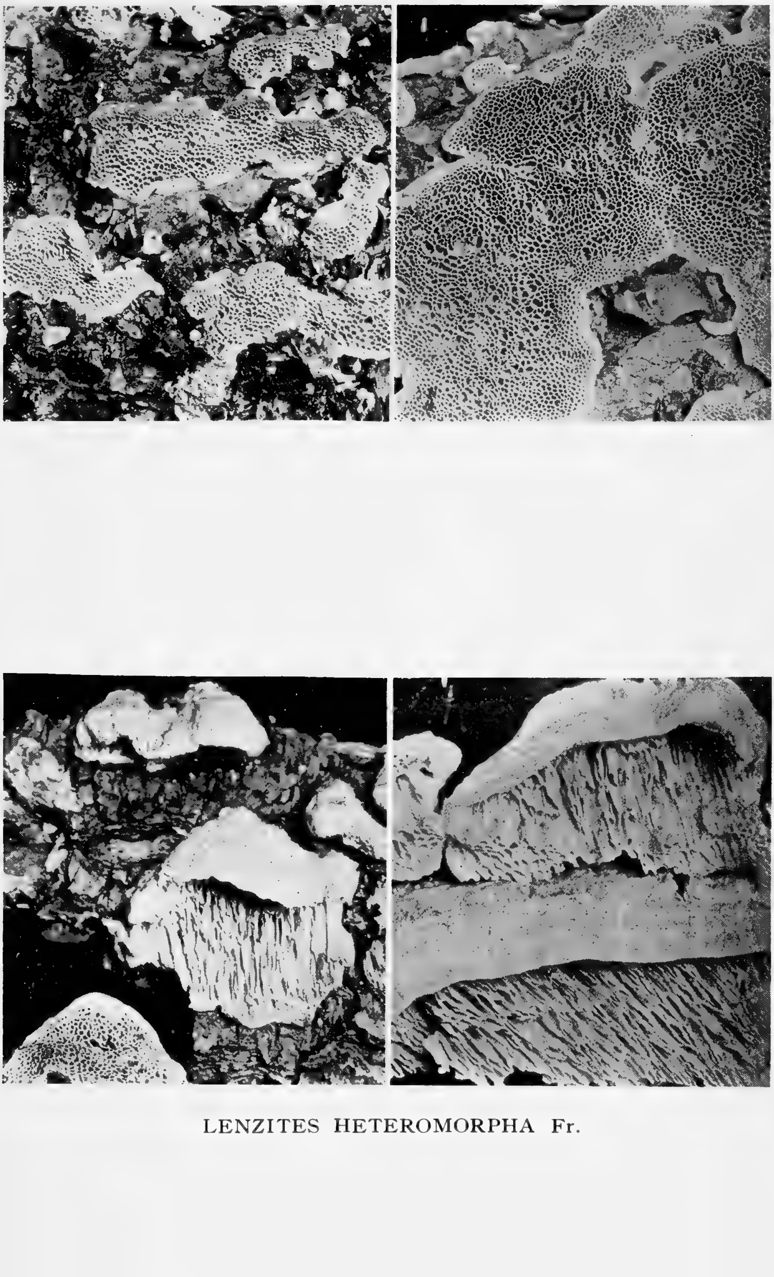
Trametes lacerata Lloyd on *Alnus tenuifolia,* Evaro, fide Lloyd.

Trametes malicola B. & C. on *Populus tremuloides,* Sioux National Forest.

Trametes mollis Fr. on *Betula occidentalis,* Bearmouth, *Populus trichocarpa,* Libby.

Trametes pargamenus Lloyd. Mr. Lloyd named this species from material collected by the writer on living *Populus trichocarpa,* Darby. It "is a thick, rigid plant, but in other features, context, violaceous pores, etc., is the same species" as *Polystictus pargamenus.* (See Lloyd Letter.)

Trametes protracta Fr. on *Pinus monticola,* Libby, *P. contorta,* DeBorgia. This is a good species and should not be considered a poroid form of *Lenzites saepiaria.* In its typical form the species is much larger than the latter, sometimes 3 to 4 by 6 inches, smooth above and is usually found on pines.



LENZITES HETEROMORPHA Fr.

Trametes sepium Berk. on *Acer negundo,* Sioux National Forest. A plant is occasionally collected from old yellow pine stumps which is in every way typical and should be referred here.

Trametes serialis Fr. on *Pinus ponderosa,* Boulder, *P. contorta,* Anaconda, *P. monticola,* Troy.

Trametes suaveoleus Fr. on *Populus trichocarpa,* Missoula, *P. tremuloides,* Monarch, and on various *Salix* spp. throughout the state. The species sometimes causes a heart rot in living trees.

Trametes tenuis Karst. (*T. setosus* Weir), on *Pinus monticola,* Troy, *P. ponderosa,* Darby, *Larix occidentalis,* Evaro.

Trametes variiformis Peck on *Larix occidentalis,* Darby.

DAEDALEA

Daedalea unicolor Fr. on deciduous trees, common throughout the state. A light colored form of this species is designated by Lloyd as *D. ochracea.* Hennings recognized an Irpex-like form as *D. unicolor* var. *hydnoidea.* Both forms are common on birch.

Daedalea confragosa Fr. on *Salix* sps., Missoula, and Neihart, *Populus tremuloides,* Libby. All the usual variations occur.

LENZITES

Lenzites saepiaria Fr. on all species of conifers and occasionally on wood of deciduous trees, rarely a wound parasite. Common throughout the state.

Lenzites betulina Fr. on dead wood of *Betula occidentalis,* Libby.

Lenzites heteromorpha Fr. on *Pseudotsuga taxifolia,* Evaro, *Abies grandis,* Libby, *Tsuga heterophylla,* Troy, *Pinus monticola,* Heron. These specimens are probably only in part correctly referred. The material shows great variation. The plant is coarse, white with white context and the hymenium may be either lamellate, daedaloid, or with large angular pores 0.4 to 1 cm. deep and 2 to 5 mm. broad. The spores are hyaline 8–11 by 3–4 μ. This plant or a closely related form seems to have been named *Trametes hexagoniformis* by Murrill. A specimen sent to Mr. Lloyd has been so referred. The accompanying photographs (*pl. 6*) show quite plainly the form variations of this plant on *Pseudotsuga taxifolia.*

Lenzites trabea Fr. on *Betula occidentalis,* Haugan, *Prunus demissa,* Libby, *Pinus contorta,* Boulder.

FAVOLUS

Favolus europaeus Fr. on dead branch of *Fraxinus viridis,* Glendive; small weathered specimen but typical except color.

OFFICE OF INVESTIGATIONS IN FOREST PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
MISSOULA, MONTANA.

THE RATE OF GROWTH AND ECESIS IN LICHENS[1]

Bruce Fink

One frequently sees statements concerning the rate of growth in lichens; but these are based, with few exceptions, on uncertain observations rather than on measurements. Aside from results obtained in cultures, the exceptions are a few measurements in Lotsy, J. P., "Beiträge zur Biologie der Flechtenflora des Hainbergs bei Göttingen" (1890) and Howe, R. H., Jr., "Aspects of New England lichens" (1908). In order to obtain sufficient data for a safe conclusion regarding the rate of growth and ecesis in lichens, the writer began a series of studies near Oxford, Ohio, and another near Big Hill, Kentucky, during the summer of 1908. At the request of a number of botanists, a preliminary statement about the work near Oxford, Ohio, was given in "Licheno-ecological studies from Beechwood Camp," published in *The Bryologist* for March, 1909. During 8 years ending with the summer of 1916, the lichens under observation had developed to such an extent, for most of the studies, that nothing would be gained by further observation. Therefore, the time has come for a final report, which may be supplemented later by recording further observations from a few of the areas.

The studies near Oxford, Ohio, may be summarized thus: 17 for rate of growth, 18 for rate of primary succession, and 18 for rate of secondary succession. Those near Big Hill, Kentucky, are 20 for rate of growth, 20 for primary succession, and 17 for secondary succession. The succession studies also furnished valuable data on the rate of growth. Of 107 studies begun, 45 are reported herein. For various reasons, the other 62 studies gave no results worth recording. Some of them were destroyed before valuable results could be obtained, while a few ran the whole 8 years without giving data of sufficient value to warrant publication. Some of the succession studies reverted to the con-

[1] Contributions from the Botanical Laboratory of Miami Univerity,—XIII.

ditions surrounding them before the 8 years had expired; 1 was destroyed by erosion; 1 was lost because of poor marking; others were destroyed through human agency; in 2 instances there was total lack of succession on chipped-rock surfaces. Of the studies of rate of growth, some of the plants under observation disappeared through destruction of the substrata on which they were growing, or through various other forms of natural or human interference. In 3 instances the plants ceased to grow soon after they had been marked; in other 3 instances the logs on which the lichens were growing were destroyed; in 5 instances the plants began to deteriorate soon after they had been marked, or possibly before the marking was done; in 4 instances the rocks on which the plants were marked disintegrated rapidly; and in 3 instances the plants appeared healthful for a long period, but failed to grow nevertheless. Though so large a proportion of the studies suffered through various vicissitudes, the 45 reported herein contain data sufficient for our purpose.

The observations were made in the Ohio area in 7 of the 8 years during which the studies ran, omitting a year after the fifth of the series of observations and another after the sixth. The results proved that the added data scarcely justified the labor involved in making observations so frequently. Consequently, in the Kentucky area, which was reached by a journey of 175 miles, 2 years were allowed to pass without observing after the second series of observations and 3 years after the third series. This gave 7 series of observations for the Ohio area and 4 for the Kentucky area. The dates of observation for the Ohio area are August 4 to 13, 1908; August 1 to 9, 1909; July 31 to August 5, 1910; July 29 to August 3, 1911; July 31 to August 4, 1912; July 11 to 18, 1914; and September 1 to 7, 1916. The dates for the Kentucky area are October 23 to 30, 1908; August 20 to 27, 1909; September 3 to 6, 1912; and August 24 to 26, 1916. Ten of the studies in Ohio were begun in 1909. Only 6 observations were made on these.

The number of sets of data for each study recorded below corresponds with the number of observations that showed changes worth recording, before the study was destroyed in some manner, before it reached a stage of development after which further

study was of no value, or before the observations were completed for the series as a whole. In the Ohio area, where the observations were made more frequently than was necessary for most of the studies, the number of sets of data for each study often does not reach the number of observations made. In the Kentucky area, the number of sets of data recorded for each study usually reaches the whole number for the area, except when the study was destroyed in some manner.

Where 2 or 3 studies lay side by side on a substratum, the same number was used for the areas, followed by (*a*) or (*b*) to indicate the second or the third of the series lying contiguously. In the Ohio area, 2 sets of numbers were used, unfortunately, 1 for the studies of rate of growth and the other for the succession studies. This accounts for the duplication of numbers for this area.

The areas are grouped below, not according to locality, but according to character of the studies and after this according to the plants involved, passing from lower to higher with respect to somatic structure.

Such expressions as 25 by 31 cm. across refer to a minimum and a maximum distance across the plant and indicate nothing regarding the form of the plants involved.

Statements regarding shade caused by trees refer of course to conditions while the leaves were on the deciduous trees.

Lichen rhizoids are known to penetrate from 0.02 to 1.4 cm. into rock; but the algal-host cells have never been found deeper than 0.5 mm. Though the rhizoids may have penetrated deeper in some instances than the rocks were chipped in our areas tabulated under primary successions, the algal hosts were certainly removed in every instance. Consequently, any remnants of the lichen rhizoids that may possibly have been left in the rocks in any instance, through failure to chip deeply enough, probably died, and the successions recorded as primary are all of this character beyond reasonable doubt.

Rate of Growth

Ohio, area 20, on the north side of a tulip tree 22 cm. in diameter, in a low, shady wood. A well-fruited specimen of

Graphis scripta, situated 1.3 m. from the ground, was 2 by 3.5 cm. across. After 1 year the plant was 3 by 4 cm. across.

Ohio, area 5, on the north side of a maple tree 16 cm. in diameter, growing along the north side of a high wood, where shaded except late in the afternoon. A well-fruited specimen of *Graphis scripta*, situated 1.6 m. from the ground, was 1 cm. across. After 1 year the plant was 1.2 cm. across. After 2 years it was 1.5 cm. across.

Ohio, area 21, over a mossy rock along a brook, in a low, moist wood, well shaded. A specimen of *Peltigera canina* 10 by 14 cm. was deprived of several large apothecia. The lobes all pointed in the same direction, and the plant grew 1.75 cm. in this direction in 1 year. The area deprived of its apothecia produced 12 young apothecia, of which only 1 was sufficiently developed at the end of the first year to show the brown disk. From 2 plants near by, the lobes were all removed, leaving the plants 2 and 5 cm. across the longest way. After 1 year the lobes were so completely regenerated that one would not know that they had been amputated. The plants were, at this time, 3.5 and 6 cm. across the longest way.

Kentucky, area 1, a quadrat 10 cm. square, situated on a sandstone ledge about 200 m. above the surrounding country, the dry rock face making an angle of 45 degrees with the horizon, and exposed to the sun during the middle of the day. Thirty plants of *Umbilicaria pustulata* were measured. After 10 months 1 minute, smooth, sterile plant had increased from 1 to 3 mm. in average diameter, while other smooth, sterile plants had increased as follows: 1 to 2 mm., 5 to 6 mm., 6 to 7 mm., 3 to 3.1 mm., 2 to 2.4 mm., 8 to 9 mm., and 6.5 to 9 mm. There were no fruited or conspicuously pustulate plants in the quadrat at this time. After 8 years the plants that remained in the quadrat were stronly pustulate and bore many apothecia. Many of the plants marked in the first study had disappeared, and younger plants had appeared in their places.

Ohio, area 4, on next to the top rail of a fence along the north border of a high, dry wood, well shaded except late in the afternoon. A smooth and sterile specimen of *Parmelia borreri* 25 cm. in diameter was marked. After 1 year the plant was 26.3

cm. in diameter and showed a few isidioid branchlets. During the second year the increase in size was about the same, and the central, oldest portion of the plant had developed many isidioid branchlets.

Kentucky, area 31, on a sandstone boulder on high, open ground, the boulder 1 by 1.5 m. across, 1 m. high, the upper surface making an angle of 10 degrees with the horizon and facing southward. Five plants of *Parmelia conspersa,* growing on the upper surface, were marked. They varied from 1 to 2 cm. across. After 10 months the plants varied from 1.5 to 2.2. cm. across. After 4 years the sizes ranged from 2.5 to 4 cm. across.

Kentucky, area 3, on the northwest side of the perpendicular face of a sandstone-conglomerate outcrop 2 m. high, standing on a high, dry, sparsely-wooded hill, where shaded until the middle of the afternoon. Two plants of *Parmelia conspersa* 40 cm. from the ground and 1 and 3 cm. across respectively were marked. After 10 months they had increased to 1.5 and 3.5 cm. across. After 4 years the plants were 3 and 7 cm. across. Both specimens were sterile throughout the 8 years of observation, and they did not grow perceptibly during the last 4 years.

Kentucky, area 6, habitat similar to Kentucky, area 3,[2] but the plants 75 cm. from the ground. Two specimens of *Parmelia conspersa* were marked, both sterile and smooth, and 1.4 and 4 cm. across, respectively. After 10 months the plants were 2.5 and 5 cm. across. After 4 years they were 3 and 8 cm. across. The plants remained smooth and sterile during the 8 years of observation; and they deteriorated toward the close of the period so that further observations could not be made.

Ohio, area 19, on a tulip tree, 22 cm. in diameter, in a low, moist wood, furnishing shade. A smooth and sterile *Parmelia caperata,* situated 1.4 m. from the ground, measured 3.5 by 4 cm. across. After 1 year the plant was 3.75 by 4.8 cm. across and still smooth and sterile.

Ohio, area 6, habitat similar to Ohio, area 5,[3] but 1.4 m. from the ground on the northwest side of the tree. The specimen of *Parmelia conspersa* studied was 1.5 cm. across when marked.

[2] See the area discussed next above.

[3] See Ohio, area 5, p. 141.

After 2 years it was 2 cm. across in one direction and 2.4 cm. across at right angles. After 3 years the plant was 2.6 and 2.9 cm. across in the 2 directions respectively.

Ohio, area 7, habitat similar to Ohio, area 5,[4] but only 0.2 m. from the ground on the north side of the tree by a little east. The specimen of *Parmelia conspersa* studied was smooth and sterile and 1 by 1.6 cm. across. After 1 year the plant was 1.3 by 1.9 cm. across. After 2 years it was 2.1 by 3 cm.; after 3 years, 3.5 by 4.1 cm.; after 5 years, 4.5 by 5 cm.; after 7 years, 7 by 8 cm.; and after 8 years, 10.2 by 12.9 cm. across. After 7 years the central portion of the thallus, about 2 cm. across, bore scattered isidioid branchlets, which increased in number and area covered during the following year.

Ohio, area 3, on next to the top rail of a fence, well shaded by a mesophytic wood, except late in the afternoon. A smooth and sterile specimen of *Parmelia caperata* 1.2 cm. across was marked. After 1 year the plant was 1.75 cm. across. After 2 years, 3 by 3.5 cm.; after 3 years, 5 cm.; after 4 years, 5.7 by 6.5 cm.; after 6 years, 7.3 by 9 cm.; and after 8 years, 10 by 13 cm. across. At the conclusion of the observations the central portion of the thallus half way to the margins was thickly covered with isidioid branchlets.

Ohio, area 1, on the northwest side of a rail lying on the ground, along the north border of a high, dry wood, well shaded except late in the afternoon. A quadrat of *Cladonia pityrea* 10 by 16 cm. was marked. No podetia were present in the quadrat, and the horizontal thallus consisted of small or minute, scattered squamules, many of them too small to be seen with the eye. After 2 years the quadrat was thickly covered with squamules of normal size for the species, and many podetia had appeared. A large proportion of these were detected under the hand lens, but 19 were visible to the eye and varied from 2 to 4 mm. long.

Ohio, area 22, on a hornblende boulder 2.5 by 4 cm., and 2 cm. high, the upper surface facing westward at an angle of 30 degrees with the hroizon and well shaded, except for an hour shortly before mid-afternoon. A specimen of *Physica pulverulenta* and one of *Parmelia conspersa* were marked. The plants were 2.4 by

[4] See Ohio, area 5, p. 141.

2.7 cm. and 1.9 c.m across respectively. After 1 year the *Physcia* was 2.75 by 3.1 cm. and the *Parmelia* 2.65 cm. across. After 2 years the *Physcia* was nearly circular and 3.6 cm. across, and the *Parmelia* was 3.5 cm. across. After 3 years the *Physcia* was 3.7 by 4 cm. and the *Parmelia* 4.3 by 4.7 cm. across. An area 0.5 cm. across near the center of the *Parmelia* had disappeared. After 5 years the *Physcia* was 4 by 4.45 cm. and the *Parmelia* 6 by 6.5 cm. across. After 7 years the *Physica* was 5. cm. and the *Parmelia* 9.5 by 10.4 cm. across. At 5 years the lost area of the *Parmelia* had increased to 1 cm. across, but at 7 years it was completely regenerated. Both plants were sterile throughout the time of observation.

Ohio, area 16, on the trunk of a beech tree 20 cm. in diameter, standing in a low, shaded wood. An area of *Amphiloma lanuginosum* 3.3 by 4.1 cm. across was marked. After 1 year the area had increased in size to 3.47 by 4.4 cm., but did not look thrifty. The area was found to be in a dying condition at the time of the next observation.

Kentucky, area 10, on a sandstone block 28 by 35 cm., and 10 cm. high, lying in a high, dry, open wood. Fourteen areas of *Verrucaria muralis* were marked, the largest 2.12 by 2.4 cm. across, the others averaging from 0.4 to 0.5 cm. across in various directions. After 10 months the largest plant was 2.2 by 3 cm. across, and the others averaged from 0.5 to 0.9 cm. across in various directions. The boulder disappeared before the time for the next series of observations.

SECONDARY SUCCESSIONS

Kentucky, area 7*a*, habitat like Kentucky, areas 6 and 7.[5] The thallus of *Amphiloma lanuginosum* was scraped from the rock over a circular area 10 cm. in diameter until no remnants were visible to the eye. The area about the study was left with the thallus of the same plant undisturbed. After 10 months there was no evidence of ecesis. After 4 years the thallus was returning over numerous centers from 0.5 to 2 mm. across. After 8 years the returning areas covered about half of the study and

[5] See Kentucky, areas 6, p. 142, and 3, p. 142.

varied from 2 to 30 mm. across. At this time the study differed in appearance from the surrounding undisturbed area only in that the areas of thallus were more scattered.

Kentucky, area 4a, habitat like Kentucky, area 4.[6] All the apothecia of *Biatorella simplex* were taken from a quadrat 5 cm. square, using the hand lens to get the smallest ones and taking also a large proportion of the epilithic parts of the thallus. After 4 years the quadrat showed numerous apothecia, some of which were 1.5 to 2 mm. in diameter.

Kentucky, area 21, on the flat top of a sandstone block near the top of a high, dry hill, the block 1 by 1.4 m., 1.3 m. high, and lying in the sun for 4 or 5 hours near the middle of the day, but shaded during the remainder of the day by a high cliff on one side and by trees on another. A quadrat of *Ramalina calicaris* was laid out 1.5 cm. square, and the *Ramalinae* were all removed, except basal remnants about 0.1 mm. long. After 10 months several plants were found that showed no evidence of having been cut off, varying in size from those too small to be seen without the hand lens to others 0.1 to 0.2 mm. long. After 8 years there were 6 plants from 2 to 5 mm. long, all sterile.

Kentucky, area 27, at the edge of a high, dry cliff facing northward, partially shaded in the forenoon by shrubs to the south. The center of a thallus of *Parmelia conspersa* 28 by 33 cm. was taken out over an area 20 by 25 cm. across, except small fragments not easily detached from the rock. Ten areas 1 to 2.5 cm. across and many other minute areas were left. After 10 months the marginal zone of the thallus had grown outward until the distance from one side of the margin to the opposite side was 29 and 34 cm. in the two directions in which the thallus had been measured previously. The inner border of the marginal zone left undisturbed showed numerous lobes regenerated and extending inward, these lobes varying in length from 1 to 15 mm. The areas left in the denuded center showed regenerated lobes about their margins, varying in length from those barely visible under the hand lens to others 3 mm. long. Also there were many minute thalli arising over the denuded center, varying in size from those only discernible by aid of the hand lens to others from 0.5 to 1 mm. across.

[6] See Kentucky, area 4, p. 151.

These probably arose from minute remnants of the thallus left in scraping the central portion of the plant from the rock. After 4 years the areas returning over the denuded center had increased in size considerably and were beginning to overlap. After 8 years a dozen regenerated thalli had covered the denuded center, except the portions covered by the regenerated lobes which had grown inward from the marginal zone not denuded to meet and overlap these. The 12 thalli varied from 2 to 5.3 cm. across. At this time the whole area was 32.3 by 40.4 cm. across.

Kentucky, area 30, 1 m. from the top in a crevice 1.5 m. wide and extending nearly north and south through the face of a high, dry, northward-facing cliff, the crevice shaded, except near the middle of the day. The thalli of *Umbilicaria pustulata* and *Gyrophora dillenii* were removed from a circular area 4 dm. in diameter, except a few fragments about 1 cm. across, left attached by the umbilici, and 9 specimens of the former plant of about the same size. Plants of the same species were left about the study, and some of those of *Umbilicaria pustulata* bore apothecia. After 10 months the fragments showed no evidence of regeneration, and the plants left had not grown sufficiently so that any increase in size could be noted. After 4 years 15 plants were found growing in the area; but it was not possible to determine which might have arisen from regeneration and which might have represented the minute plants left when the study was plotted. The largest plant was 3.8 by 4.2 cm. across, and this and two other plants of *Umbilicaria pustulata* were sparingly covered with pustules. The other 12 plants were from 0.3 to 2.1 cm. across. After 8 years about 40 plants of the two species were found growing in the area. Fourteen specimens of *Umbilicaria pustulata* averaged 2.5 to 5 cm. across in various directions and were conspicuously pustulate. Six of them showed young apothecia from 0.2 to 0.4 mm. across. Twelve specimens of *Gyrophora dillenii* were 1.5 to 3.45 cm. across.

Kentucky, area 13, on top of a limestone rock 0.9 by 1 m. across and 20 cm. high, on a partially shaded, dry hillside, the upper surface of the rock making an angle of 60 degrees with the horizon. All the large specimens of *Dermatocarpon miniatum* were taken from a quadrat 17 cm. square, leaving many small

thalli averaging 0.25 to 9 mm. across in various directions. Some of the plants were in groups of 2 to 15 or 20; and the individual plants of the groups were often too small to be seen without the hand lens. All the plants left were sterile. After 10 months the plants had grown but little, the largest one being but 11 mm. across. After 4 years 1 plant was found 13.7 by 14.3 mm. across and another 11.3 by 12.5 mm. across. The remainder of the plants averaged for most part from 0.4 to 1.5 mm. across in various directions. All were still sterile.

Ohio, area 13, a quadrat 19 cm. square, plotted on a boulder 0.7 m. high, 2 m. from a brook in a damp wood. The quadrat was thoroughly scraped with a knife blade, and only minute particles of *Physcia endochrysea, Leptogium lacerum,* and the small number of mosses and leafy hepatics interspersed were left adhering to the surface of the rock. After 1 year *Physcia endochrysea* was returning in 30 areas, varying in size from those barely distinguishable under the hand lens to others 1 mm. across. *Leptogium lacerum* was returning in several spots in the quadrat; but the plants were visible only under the hand lens. Bryophytes were also returning and gave a green coloration to portions of the quadrat not covered by lichens; but their gross structure was distinguishable only under the hand lens. After 2 years *Physcia endochrysea* was found growing in 60 spots in the quadrat; and the plants varied from 0.2 to 1.5 cm. across. Some of them were visible 60 m. distant. The other plants showed little change. After three years the largest *Physcia endochrysea* was 1.75 cm. across, and 10 others were 1 cm. across or larger. The bryophytes covered a considerable portion of the remaining area, and the plants were as large as those surrounding the quadrat. The remainder of the quadrat was covered mainly by *Verrucaria nigrescens* sparsely fruited. Poorly developed thalli of this lichen were probably present when the quadrat was plotted, but were covered by other lichens and bryophytes and grew rapidly only after the cover plants had been removed. At this time and at later periods only 3 or 4 minute centers of *Leptogium lacerum* were found within the quadrat. After 7 years *Physcia endochrysea* and the bryophytes covered about three-fourths of the quadrant in approximately equal areas, and *Verrucaria nigrescens*

had taken the other one-fourth. The quadrat had reverted to conditions found over the remainder of the rock; for *Leptogium lacerum* had largely disappeared, while *Verrucaria nigrescens* had become conspicuous without the quadrat as well as within it. The *Physcia* was sterile both within and without the quadrat.

Kentucky, area 12, on the upper surface of a boulder 80 by 140 cm. and 30 cm. high, lying on a dry hillside, the upper surface making an angle of 35 degrees with the horizon and exposed to the sun, except during half of the forenoon. A small area of *Psora russellii* was stripped of apothecia. After 10 months the area showed 2 small apothecia. After 4 years 50 apothecia were found, some of them of average size for the species. After 8 years more than 100 apothecia were present.

Kentucky, area 14, a quadrat 30 by 40 cm. on a limestone rock 40 by 100 cm. and 75 cm. high, lying in an open, dry wood where poorly shaded, the upper surface making an angle of 15 degrees with the horizon. *Leptogium lacerum* and the moss on which it was growing were rubbed and scraped from the rock, except bits of the moss and particles of the lichen which adhered to the rock, especially in depressions of the rock surface. After 4 years the moss was found returning over 300 or more small areas, many of them bearing specimens of *Leptogium lacerum* 2 to 10 mm. across. Very little change occurred during the next 4 years.

Kentucky, area 25, a quadrat 32.5 by 45 cm. at the top of a high, dry cliff facing northward, the quadrat on bare rock at the edge of the cliff, but on soil 16 cm. deep at the opposite side, partially shaded during the forenoon by low shrubs. Many plants of *Cladonia uncialis, C. cristatella, C. fimbriata,* and *C. pyxidata* were torn and pounded from the *Polytrichum* on which they were growing, and the fragments were strewn over the quadrat. After 4 years *Cladonia uncialis* and *C. pyxidata* were both abundant and well developed with many podetia of normal form and size. After 8 years the 2 lichens had taken the quadrat, and about one-fourth of the podetia of *Cladonia pyxidata* bore apothecia.

Kentucky, area 24, habitat similar to Kentucky 25,[7] but back 2 m. from the edge of the cliff, on soil 0.5 m. deep over the rock. The quadrat, 10 by 14 cm., was covered by *Cladonia uncialis*

7 See the area discussed next above.

growing over mosses. The *Cladonia* was removed as thoroughly as could be done over part of the quadrat, while over the remainder of its surface the upper half of each podetium was cut off, leaving the basal portion 1 to 1.5 cm. long. Over the portion from which the plants had been removed as completely as possible, the podetia were broken into small or minute fragments and worked into the mossy substratum to test the rate of regeneration. After 4 years the plants were regenerated, and *Cladonia uncialis* was as luxuriant as over surrounding undisturbed areas. The regenerated plants were particularly luxuriant over the portion of the quadrat on which the fragments had been worked into the substratum.

Ohio, area 10, a quadrat 10 cm. long on the third rail from the top of a fence in a mesophytic wood, well shaded during the forenoon and partially shaded during the afternoon. *Cladonia pityrea* covered the quadrat, and the podetia and as much as possible of the squamules were removed that the rate of ecesis or regeneration might be studied. After 1 year squamules had developed strongly, and two minute podetia were visible to the eye. After 3 years the quadrat showed many podetia from 3 to 5 mm. long.

Ohio, area 11, a quadrat 65 cm. long on the upper side of the second rail from the top in a fence along a roadside in a mesophytic wood, well shaded in the forenoon and partially shaded during the afternoon. All visible portions of the 3 or 4 species of *Cladonia* which covered the quadrat were removed, leaving the rotted surface of the rail. After 1 year squamules were returning over most of the quadrat and were of sufficient size and number to be seen at a distance of 3 m. After 3 years 40 podetia were present in a small portion of the quadrat. These were 3 to 4 mm. high, and most of them bore cups.

Kentucky, area 5a, habitat like Kentucky, areas 3 and 5. The thallus of *Cladonia subsquamosa* was taken from a quadrat 5.5 by 1.75 cm., leaving only such fragments as could not be removed from the rock surface. After 10 months a few squamules could be seen in the quadrat. After 4 years the squamules had reached normal size and number, and 50 podetia were developing. After 8 years the podetia as well as the squamules were as numerous and as large as those in surrounding undisturbed areas.

Kentucky, area 5b, habitat like Kentucky, areas 3 and 5.[8] All the podetia of *Cladonia subsquamosa* were removed from a quadrat 2 by 4.5 cm., but the squamules were left. After 10 months 35 short podetia were detected. After 4 years the podetia were numerous and of normal size.

Ohio, area 23, on the top 3 rails of 24 rail-lengths of fence, the rails mostly of sound tulip-poplar and placed in the fence in October, 1908, the area lying along a roadside where exposed to the sun, except under 2 large beech trees where shaded until mid-afternoon. After 2 years 2 minute specimens of *Parmelia tiliacea* were found on a new rail under one of the beech trees. After 6 years several *Physcia tribacia* plants were found on a new rail under one of the beech trees, the largest *Physcia* 5 by 7 mm. One *Parmelia* found 4 years before was now 2 cm. across. On another new rail under one of the beech trees, a strip of *Cladonia* squamules was found scattered over the rail for a distance of 10 cm. On a new rail exposed to the sun was found a *Cladonia* with several minute podetia. One of the new, exposed, top rails showed the thallus of *Placodium microphyllimum* scattered over the whole length of the rail. After 8 years the largest *Physcia tribacia* was 2.5 cm. across, the larger *Parmelia tiliacea* was 6 cm. across, and *Placodium microphyllinum* was found on several new rails scattered along the whole 24 rail-lengths. The last plant bore several apothecia.

Kentucky, area 23, a quadrat of soil 60 by 70 cm., denuded 3 cm. deep and some sticks devoid of lichens scattered over the quadrat, which was poorly shaded by a dry, open wood. The quadrat, before being denuded, was covered by the following plants: several areas of *Cladonia subcariosa*, an area of *C. cervicornis*, some crustose lichens on small stones, and a few mosses which covered the small proportion of the soil not covered by the *Cladoniae*. After 10 months *Cladonia* squamules were beginning to appear on the soil throughout the quadrat. These were large enough to be seen plainly with the eye. Unfortunately, the quadrat was destroyed before another observation could be made.

Kentucky, area 8, an eastward-facing ledge of conglomerate sandstone 4 m. high, lying on a high, sparsely-wooded hill,

[8] See Kentucky, area 5, p. 154, and Kentucky, area 3, p. 142.

partially shaded by shrubs on the east and by the rock face on the west, the rock projecting over the area, which is seldom reached by rain. Over a circular area of *Lecanora frustulosa* 10 cm. across and 1.8 m. from the ground, the apothecia and most of the epilithic portion of the thallus were scraped from the rock, using the hand lens to get minute apothecia and fragments of thallus. No development was detected until 8 years had passed when several small areas of thallus and a few apothecia 0.2 to 0.25 mm. across were found. The hardness of the substratum and the lack of moisture probably account for the unusually slow rate of development.

PRIMARY SUCCESSIONS

Ohio, area 15, a limestone 3.5 by 5.5 cm., largely imbedded in the soil on a northward-sloping, mesophytic hillside, the rock surface level with the soil to 2 cm. above, exposed to the sun. The upper surface, covered mainly by *Pannaria nigra* and a moss, was chipped on the side raised above the soil 1 to 2 cm. deep over a quadrat 2 by 4 cm. After 2 years 4 minute areas of *Pannaria nigra* were found within the quadrat, 2 of which bore one minute apothecium each. After 5 years many more minute lichen thalli were found in the quadrat, but they were too young to be identified. After 7 years a half dozen areas of *Pannaria nigra* were found. Apothecia were few in number. The largest thallus was 1 cm. across and bore 6 well-developed apothecia. The largest of these was 0.5 mm. in diameter.

Kentucky, area 4, habitat like Kentucky, area 3.[9] In an area of *Biatorella simplex,* a quadrat 10 cm. square was made by chipping the rocks 2 to 10 mm. deep. After 4 years many minute areas of thalli were found within the quadrat. After 8 years many minute apothecia were observed under the hand lens. The largest apothecia were 0.25 mm. across, while the largest in undisturbed areas surrounding the quadrat were 2 mm. across.

Kentucky, area 2, on a limestone 8 by 11 cm., lying on dry soil near the top of a steep, wooded hill about 200 m. high, the upper surface of the limestone lying in a horizontal plane, with one of its sides level with the soil while the opposite side was 9 cm. above the soil. *Verrucaria rupestris, Staurothele diffractella, Pyre-*

9 See Kentucky, area 3, p. 142.

nopsis schaereri, Placodium sideritis, Collema pustulatum, and *Physcia obscura* (?) were growing on the upper surface of the rock, from which the front one-fourth and the back one-fourth were chipped 2 to 15 mm. deep. After 4 years many minute primordia of lichen thalli were found under the hand lens, within the chipped quadrats. After 8 years these quadrats were sprinkled over with minute thalli of *Pyrenopsis schaereri,* a few small thalli of *Physcia obscura* (?), and several minute and sterile ones of *Collema pustulatum.* All of these thalli were sterile; but a single specimen of *Placodium sideritis* 1.5 cm. across bore 4 minute apothecia.

Ohio, area 7, on a limestone 65 by 5 cm. and 35 cm. high, standing nearly erect in a moist, shady wood, the quadrat covering half of the 65 cm.-wide, nearly perpendicular rock face, chipped 4 to 18 mm. deep. After 2 years all of the chipped quadrat showed an indistinct green coloration, in which the hand lens revealed scattered areas turning toward the dark color characteristic of *Verrucaria nigrescens,* which had covered most of the rock surface before the quadrat was plotted. After 6 years this lichen was found over more than half of the chipped quadrat with numerous apothecia, and thallus nearly as dark as on surrounding undisturbed areas.

Kentucky, area 7, habitat like Kentucky, area 6.[10] In an area covered by *Amphiloma lanuginosum,* a circular portion 10 cm. in diameter was chipped 1 to 10 mm. deep. After 4 years the *Amphiloma* was found returning in patches averaging 0.5 to 2 mm. across in various directions and scattered over the whole area. After 8 years the plant covered about three-fourths of the surface, and a considerable number of larger patches ran from 5 to 10 mm. across in various directions.

Ohio, area 8, from a levee 1.3 m. wide and 0.3 m. high, lying 9 m. from a brook, on usually dry ground exposed to the sun, the limestone fragments composing the levee of sizes easily handled, removed a portion 70 cm. long and replaced it by similar limestone fragments taken from the bed of the brook and devoid of plant growth that could be detected. After 3 years thalli of *Endocarpon pusillum* 0.2 to 2 mm. across were found in con-

[10] See Kentucky, area 6, p. 142.

siderable abundance on one of the rocks and more sparingly on others. Other thalli were supposed to be the same, but were too immature to be determined. Over most of the replaced portion of the levee, the thalli could be seen only under the hand lens; but at a few points, the darker coloration of the rock could be detected in passing. None of the plants bore apothecia. After 4 years a few of the thalli of *Endocarpon pusillum* showed apothecia; and hundreds of apothecia of *Placodium aurellum* were scattered over some of the rocks. After 6 years the *Endocarpon* had developed many apothecia; and one could easily detect the coloration of the rocks, due to its thallus, from a standing position 8 m. distant. The *Placodium* apothecia had not increased greatly in number. Eight apothecia of *Lecanora dispersa* were seen on one rock. After 8 years the coloration due to the *Endocarpon* thallus could be seen easily over much of the rock when standing 20 m. distant. The apothecia of the *Placodium* were much more numerous, but would be noticed only under the hand lens. The apothecia of the *Lecanora* were still rare and, excepting one group which was easily visible from a standing position, were readily visible only under a hand lens. The thalli of the last 2 lichens could be seen only by aid of the lens.

Ohio, area 12, a soil quadrat 1 m. square on high ground in an open wood, denuded 5 cm. deep, removing all plant parts, except roots of seed plants which extended deeper into the soil and could not be pulled out. The quadrat, before being denuded, was covered by lichens and mosses, with about 85 herbs and 2 seedling trees scattered about within its limits. *Cladonia furcata* was the only abundant lichen. *Cladonia pyxidata* was present in several small patches, and a small cluster of *Cladonia mitrula* was seen. After 1 year 36 clusters of *Cladoniae* were noted within the quadrat, all so small as to be visible only on careful observation and too rudimentary to be determined. Herbs, mosses, and seedling trees were also appearing. After 5 years the quadrat had reverted to the conditions found in the surrounding area so far as the lichens were concerned. *Cladonia furcata* was again dominant and of the same size and appearance within as without the quadrat.

Kentucky, area 26, habitat like Kentucky, area 25,[11] a soil

[11] See Kentucky, area 25, p. 148.

quadrat 3 by 7 dm., denuded 5 cm. deep, removing the lichens and the superficial portions of the *Polytrichum* on which these were growing. *Cladonia pyxidata* and *C. cristatella* were abundant, and 4 other *Cladoniae* were seen in small quantities. After 2 months many small *Cladonia* squamules were observed in the quadrat. After 4 years a considerable number of specimens of *Cladonia pyxidata* of normal size were observed. After 8 years the quadrat had reverted to the conditions surrounding it. *Cladonia pyxidata* was abundant with 300 podetia within the quadrat. More than 30 podetia bore apothecia. A small amount of *Cladonia cristatella* was present and bore apothecia sparingly. Smaller amounts of 3 or 4 other *Cladoniae* were seen.

Kentucky, area 5, habitat like Kentucky, area 3,[12] a quadrat 4.5 by 5.5 cm., denuded 2 to 10 mm. deep. The quadrat was covered by *Cladonia subsquamosa,* which also grew on the surrounding rock. After 10 months *Cladonia* squamules were detected in considerable number within the quadrat. After 4 years the squamules had increased considerably in size and number. After 8 years squamules of normal size covered one-fourth of the quadrat and bore 20 fully developed podetia. Nearly all of these podetia bore apothecia. Many smaller pedetia were seen.

Kentucky, area 28, habitat similar to Kentucky, area 27,[13] but back 1 m. from the edge of the cliff where more shaded. A quadrat 3 by 4 dm. on soil 3 dm. or more deep was denuded 4.5 cm. deep. *Cladonia pyxidata* and *C. cristatella* in large quantity and *Cladonia verticillata* and *C. squamosa* in small quantity nearly covered the mossy substratum, A small amount of *Polytrichum,* a half dozen low huckleberry bushes, 3 or 4 clumps of grass, and a few other herbs were present. All plant parts were removed from the quadrat, except such roots as extended below the depth of denudation and could not be pulled out. After 10 months many small *Cladonia* squamules were found growing within the quadrat, and about the margin were clusters of larger squamules which bore podetia. These had been carried into the quadrat in some manner. After 4 years *Cladonia pyxidata* was present in large quantity. The squamules were scattered over the whole quadrat, and a considerable number of podetia of normal size

[12] See Kentucky, area 3, p. 142.

[13] See Kentucky, area 27, p. 145.

were present. The other *Cladoniae* were present in small numbers.

Kentucky, area 29, habitat similar to Kentucky, area 28,[14] but 10 m. distant from this and 3.5 m. back from the edge of the cliff in soil of considerable depth. A quadrat 4 dm. square was denuded 5 cm. deep. Growing in the quadrat were 3 greenbriers, 3 huckleberry bushes, 2 seeding pines, a few clumps of grass, a conspicuous covering of *Cladonia cariosa* with few podetia and apothecia, and a few well-developed plants of *Cladonia cristatella* and *C. uncialis*. After 10 months many small *Cladonia* squamules were found scattered over the quadrat. After 4 years the squamules were of larger size. After 8 years the squamules had covered a large proportion of the quadrat, and 25 podetia of *Cladonia cariosa* were counted, some of which were of normal size.

Ohio, area 9, on a new plane-tree board, next to the top in a fence on dry ground and exposed to the sun. The new board was placed in the fence 3 weeks before the study was begun, and the old boards above and below the new one were covered along the top edge and the sides by *Placodium microphyllinum*. After 2 years 15 minute areas of the *Placodium* thallus were visible to the eye on the top edge of the new board, the largest area being 1 mm. across. After 3 years hundreds of areas of the thallus were seen scattered over the whole top of the board, some barely visible to the eye, others reaching 0.5 cm. across, while the smallest were visible only under the hand lens. After 4 years the areas of thallus were more numerous and larger, and an examination of the whole length of the board with the hand lens resulted in finding 2 young apothecia, one of them with the disk open. After 6 years the thallus was as abundant and as fully developed on the top edge of the board as on the old boards and could be seen 20 m. distant. There were also a few small areas of the thallus on the sides of the new board near the top edge at this time. The lowest of these was 5 cm. down from the edge. Eleven apothecia were found at this time. After 8 years the apothecia were as frequent on the top edge of the new board as on the old boards. The thallus was not distinctly more abundant on the new board than it was at 6 years.

[14] See Kentucky, area 28, p. 154.

SUMMARY

One may speculate about possible or probable methods of migration to the denuded quadrats; but nothing is definitely known further than seeing parts of *Cladonia* thalli lying on some of the quadrats in early stages of ecesis. Other possible methods are through fragmentation, through soredia, and through spores. Some probable speculations regarding the means of ecesis might have been made for some of the studies, but this would have been scarcely worth while in the absence of definite data.

Many of the results recorded above cannot be summarized readily, and one must refer to the various studies for such data. Of data which are readily summarizable, the more important are given below.

Graphis scripta increased in diameter from 0.2 to 0.75 cm. in 1 year. *Verrucaria muralis* increased in diameter 0.6 cm. in 1 year. *Physica pulverulenta* increased in diameter for 7 years at the rate of 0.42 cm. per year. *Parmelia borreri* increased in diameter 1.3 cm. in 1 year. *Parmelia caperata* increased in diameter from 0.625 to 1.3 cm. per year for 8 years. *Parmelia conspersa* increased in diameter for 7 years at the average rate of 1.16 cm. per year. *Umbilicaria pustulata* increased in diameter for 8 years at the average rate of 0.36 cm. per year. *Peltigera canina* grew 1.75 cm. in one direction in 1 year.

Biatorella simplex replaced apothecia removed from sandstone conglomerate in 4 years, and sterile *Psora russellii* growing on limestone produced apothecia in the same time. An area of *Peltigera canina* deprived of its apothecia produced 12 young ones in 1 year. Smooth and sterile plants of *Umbilicaria pustulata* growing on high sandstone became strongly pustulate and produced apothecia in 7 years. *Cladonia subsquamosa* on sandstone conglomerate, when deprived of its podetia, regenerated them or produced others in 4 years. The same plant removed from the sandstone conglomerate, except minute fragments, produced squamules of normal size in 4 years and podetia of normal size in 8 years. *Cladonia pityrea* on rails, deprived of its podetia and squamules, except minute fragments, produced normal squamules in 1 year and numerous podetia in 3 years. *Cladonia*

uncialis in a denuded quadrat on thin soil regenerated new plants of full size in 4 years, from fragments thrown over the quadrat.

Verrucaria nigrescens became established in a denuded limestone quadrat and produced apothecia in 6 years. *Placodium aurellum* became established on limestone and produced apothecia in 4 years. *Placodium microphyllinum* became established on a new plane-tree board in 2 years and produced apothecia in 6 years. *Lecanora dispersa* became established on limestone and produced apothecia in 6 years. *Pyrenopsis schaereri* and *Collema pustulatum* became established on denuded limestone in 8 years, and *Placodium sideritis* became established and produced apothecia in the same time. *Pannaria nigra* became established and produced apothecia on denuded limestone in 7 years. *Endocarpon pusillum* grew and became established and produced apothecia on limestone in 4 years. *Amphiloma lanuginosum* became established on denuded sandstone conglomerate and was plainly visible after 4 years. *Cladonia pyxidata, C. fimbriata,* and *C. mitrula* became established on soil in a denuded quadrat and reached normal size in 5 years. *Cladonia pyxidata* and *C. cristatella* became established on denuded rock and produced podetia and apothecia of normal size in 8 years. *Cladonia subsquamosa* became established on denuded sandstone conglomerate and produced podetia and apothecia of normal size in 8 years.

Certain crustose lichens become established and produce thalli and apothecia in denuded areas in 2 to 8 years. Foliose lichens increase in diameter from 0.3 to 3.5 cm. per year. *Cladoniae* regenerate squamules in one or two years and podetia in 3 or 4 years, and these plants become established by succession in 4 to 8 years.

So far as external appearance goes, lichens produce apothecia in their natural habitats in 1 to 8 years; but, except in instances of primary succession, it is not certain but that the primordia of apothecia were present within the thalli at the time that the various studies given herein were begun. From the studies of primary succession, it would seem that the full development of apothecia to the point when they assume their mature form requires from 4 to 8 years when the plants are growing in their natural habitats.

However, much shorter times have been recorded for development in cultures.

Other similar data could be summarized. However, they would scarcely add to the conclusions regarding the rate of growth and ecesis in lichens, a subject about which so little has been known that one could scarcely form any opinion based on knowledge.

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TENNESSEE AND KENTUCKY FUNGI

C. H. Kauffman

The fungous flora of Tennessee and Kentucky has not been studied to the same extent as that of many other states. The main work so far seems to have been limited to the more important disease-producing species on cultivated plants. In addition, collections have been made in a few special groups confined to the eastern mountains. The general flora of the central and western portions of these states remain practically untouched.

During the month of September, 1916, the writer, accompanied by Mr. Frank B. Cotner as assistant, visited two localities. One week was spent at Harlan, Kentucky, and three weeks at Elkmont, Tennessee, in the heart of the western slopes of the Big Smoky Mountains. The latter region is not far remote from the Asheville region of North Carolina where so many eminent mycologists have collected and whose flora is quite well known. Many species were therefore found which are known from the ranges east of the Big Smoky.

The most important condition for the study of the fungous flora of a region is of course the weather. Heavy rains had fallen in Elkmont during July and August, so that the wood-inhabiting fungi were still rather plentiful. The species growing on the ground, however, were not in sufficient abundance to give any satisfactory idea of the flora, as the rains during our stay were few and scattered, and the summer fruiting species had all been stimulated by the heavy rains to early fruiting. The following list of agarics, for example, although not small, represents in each case a small number of individuals collected, giving no hint of the frequency of the species for the region.

Since the larger part of the list below comes from Elkmont, Tennessee, the species from Harlan, Kentucky, will be marked by an asterisk and those common to the two localities by a double asterisk.

PHYCOMYCETES

**Synchytrium decipiens* Farl. On *Amphicarpaea monoica.*
**Cystopus Convolvulacearum* Otth. On *Ipomoea purpureum.*

ASCOMYCETES

GEOGLOSSACEAE

Geoglossum difforme (Fr.) Durand.
Geoglossum fallax Durand.
Geoglossum nigritum Cooke.
Trichoglossum Walteri (Berk.) Durand.
Leotia lubrica Pers.
Leotia stipitata (Bosc.) Schroet.
**Microglossum rufum* (Schw.) Underw.

HELVELLACEAE

Helvella atra König.
Helvella lacunosa Afzel.

PEZIZACEAE

Lachnea hemispherica (Wigg.) Gill.
Lachnea scutellata Gill.
Macropodia macropus Fuckel.
Plicaria vesiculosa Bull.

HALOTIACEAE

Chlorosplenium aeruginosum (Oed.) De Not.
**Chlorosplenium versiforme* De Not.
**Sarcascypha occidentalis* Schw.
**Geopyxis nebulosa* (Cooke) Sacc.

CENANGIACEAE

***Sarcosoma carolinianum* Durand. The ascospores of this species are slightly smaller than required, measuring $22–28 \times 10–12\ \mu$. It was found several times both on wood and decaying leaves.

HYSTERIACEAE

**Glonium stellatum* Muhl.

ERYSIPHOCEAE

Microsphaera Vaccinii (Schw.) C. & P.

HYPOCREACEAE

Cordyceps ophioglossoides Lk.
***Cordyceps militaris* (L.) Lk.
Hypocrea pallida Fr.
Hypocrea patella Cooke & Pk.
Hyphomyces aurantiacum (Pers.) Tul.
***Podostroma alutacea* (Pers.) Atk.
Chromocreopsis cubispora (Ellis & Holw.) Seaver.

Although the plants found differ in size, shape, and habit from the description of the above species it is not different. The stromata are caespitose-connate or confluent, forming tubercular masses 1–1.5 cm. high and as much as 2 cm. broad, empire-yellow (Ridg.) within and without, the parts subpyriform, *i. e.*, narrowed to the base, obtuse-rounded above, glabrous, punctate by the slender projecting dark olive ostioles; asci 8-spored, sp. pt. 50–55 × 5–6 μ; spores cuboidal, 5–6 × 4–5 μ, dark-olive; spore-print blackish-olive. On old logs.

Nectra cinnabarina Fr.

SPHAERIACEAE

Melanomma verrucaris (Fr.) Sacc.

DIATRYPACEAE

**Diatrype stigma* De Not.
**Diatrype virescens* Schw.
**Diatrypella favacea* (Fr.) Nitsche.

VALSACEAE

**Eutypella glandulosa* (Cooke) Ellis.

MELOGRAMMATACEAE

**Valsaria exasperans* (Gerard) Ellis. More properly *Myrmaecium exasperans* (Gerard). Syn: *Diatrype quadrata,* etc.

XYLARIACEAE

**Daldinia concentrica* Ces. & De Not.
Hypoxylon coccinea Bull.
**Hypoxylon cohaerens* Muhl.
**Hypoxylon Howeianum* Pk.
**Hypoxylon rubiginosum* Fr.
Xylaria digitata Grev.
**Xylaria polymorpha* (Schroet.) Grev.

UREDINALES

MELAMPSORACEAE

**Coleosporium Campanulae* (Pers.) Lev. On *Campanula americana.*
Coleosporium inconspicuum (Long) H. & L. On *Coreopsis major.*
Coleosporium Ipomeae (Schw.) Burr.
***Coleosporium Solidaginis* (Schw.) Thüm. On *Solidago* ssp.
***Coleosporium Vernoniae* B. & C. On *Vernonia* sp.
**Pucciniastrum Hydrangeae* (B. & C.) Arth. On *Hydrangea arborescens.*

PUCCINIACEAE

Puccinia atropuncta Pk. & Clint. On *Melanthiium parviflorum.*
**Puccinia Circaeae* Pers. On *Circaea intermedia.*
**Puccinia Helianthi* Schw. On *Helianthus microcephalus.*

**Puccinia Menthae,* forma *americana* Burr. On *Cunila origanoides.*
Puccinia Smilicis Schw. On *Smilax rotundifolia.*
**Uromyces appendiculata* (Pers.) Lk. On *Phaseolus vulgaris.*
**Uromyces Euphorbiae* C. & P. On *Euphorbia Preslii.*
**Uromyces Hyperici* (Schw.) Curt. On *Hypericum* sp.
Uromyces Lespedezae-procumbentis (Schw.) Curt. On *Lespedeza* ssp.

BASIDIOMYCETES

THELEPHORACEAE (*fide Burt.*)

Corticium albulum Atk. & Burt.
Corticium alutaceum (Schrad.) Brid.
**Corticium polyporideum* B. & C.
***Craterellus odoratus* Schw.
Hymenochaete agglutinans Ell.
Hymenochaete Curtisii (Berk.).
***Hymenochaete tabacina* Fr.
**Hymenochaete purpurea* Cooke.
***Hymenochaete rubiginosa* (Dicks.) Lév.
**Peniophora Allescheri* Bres.
***Peniophora cinerea* Fr.
**Peniophora isabellina* Burt.
Peniophora velutina (D. C.).
Sebacina incrustans (Pers.) Tul.
**Solenia confusa* Bres.
**Stereum bicolor* Fr.
Stereum cinerascens (Schw.).
***Stereum frustulosum* Fr.
Stereum hirsutum Fr.
**Stereum lobatum* Fr.
Stereum ochraceoflavum Schw.
***Stereum rameale* Schw.
Stereum sanguinolentum Fr.
***Stereum sericeum* Fr.
Stereum sulcatum Burt.
Stereum tuberculosum Fr.
Thelephora albidobrunneus Schw.
Thelophora humicola Burt.
Thelephora regularis Schw.
**Tremellodendron candidum* (Schw.).

HYDNACEAE

***Irpex cinnamomeus* Fr.
***Irpex farinaceus* Fr.
Irpex tulipifera Schw.
Hydnum adustum Schw.
Hydnum albidum Pk.
Hydnum coralloides Fr.
**Hydnum ferruginosum* Fr.
***Hydnum ochraceum* Fr.
Hydnum putidum Atk.
**Hydnum pulcherrimum* B. & C.
Hydnum scrobiculatum Fr.
Hydnum septentrionale Fr.
Hydnum repàndum Fr.
***Hydnum velutinum* Fr.
Odontia Wrightii B. & C.
Phlebia albida Fr.
Phlebia radiata Fr.

CLAVARIACEAE

Clavaria asperula Atk.
Clavaria curtus Fr.
***Clavaria flava* Fr.
Clavaria fusiformis Fr.
Clavaria mucida Fr.
Clavaria pistillaris Fr.
Clavaria pulchra Pk.
Clavaria pyxidata Fr.
Clavaria rugosa Fr.
***Clavaria stricta* Fr.

POLYPORACEAE

Boletus bicolor Pk.
Boletus castaneus Fr.
Boletus granulatus Fr.
Boletus luridus Fr.

Boletus luteus Fr.
***Boletus ornatipes* Pk.
Boletus retipes B. & C.
***Fistulina hepatica* Fr.
***Fomes applanatus* Fr.
Fomes conchatus Fr.
***Fomes connatus* Fr.
Fomes fomentarius Fr.
Fomes pinicola Fr.
***Fomes rimosus* Berk.
***Polyporus adustus* Fr.
***Polyporus albellus* Pk.
Polyporus benzoinus Fr.
**Polyporus Berkeleyi* Fr.
**Polyporus caesius* Fr.
Polyporus chioneus Fr.
Polyporus confluens A. & S.
Polyporus cristatus Fr.
***Polyporus cuticularis* Fr.
***Polyporus elegans* Fr.
***Polyporus fissilis* B. & C.
Polyporus floriformis Bres. fide Lloyd.
***Polyporus galactinus* Berk.
***Polyporus gilvus* Fr.
Polyporus guttulatus Pk.
***Polyporus lucidus* Fr.
Polyporus Peckianus B. & C. fide Lloyd.
Polyporus picipes Fr.
***Polyporus Pilotae* Schw.
Polyporus resinosus Fr.
Polyporus semisupinus B. & C.
Polyporus Spraguei B. & C.
Polyporus spumeus Fr.
***Polyporus sulphureus* Fr.
Polystictus barbatulus Fr.
Polystictus biformis Klotsch.
**Polystictus haedinus* Berk. fide Lloyd.
**Polystictus hirsutellus* Schw. fide Lloyd.
Polystictus hirsutus Fr.
***Polystictus pergamenus* Fr.
***Polystictus sanguineus* Fr.
Polystictus velutinus Fr.
**Polystictus versicolor* Fr.
**Porothelium fimbriatum* Fr.
Poria attenuata Pk.
Poria ambigua Bres.
Poria betulina (Murr.).
***Poria cinerea* Schw.
***Poria ferruginosa* Fr.
Poria medullae-panis Fr.
Poria nitida Fr.
Poria pulchella Pk.
Poria purpurea Fr.
Poria semitincta Pk.
***Poria subacida* Pk.
Poria sulphurella Pk. fide Lloyd.
Poria undata (Pers.) fide Lloyd.
Poria vaporarius Fr.
Poria vitellina Schw. fide Lloyd.
Poria vulgaris Fr.
Poria Xantha Fr.
Poria spp.
**Gloeoporus dichrous* (Fr.).
Trametes carnea Cooke.
**Trametes mollis* Fr.
Trametes robiniophila Murr.
**Trametes sepium* Fr.
**Trametes serpens* Fr.
**Daedalea ambigua* Berk.
***Daedalea confragosa* Fr.
**Daedalea unicolor* Fr.
***Favolus europaeus* Fr.
**Favolus Rhipidium* Berk.
Merulius corium Fr.
Merulius molluscus Fr.
Merulius rubellus Pk.
Merulius tremellosus Fr.
Merulius subaurantiacus Pk.
***Lenzites betulina* Fr.
***Lenzites sepiaria* Fr.
***Lenzites vialis* Pk.

AGARICACEAE

***Amanita flavoconia* Atk.
Amanita mappa Fr.
Amanita muscaria Fr.
**Amanita rubescens* Fr.
Amanita solitaria Fr.
Amanita tomentella Kromb.

**Amanita verna* Fr.
Amanitopsis vaginata Roze.
Amanitopsis farinosa Schw.
Armillaria mellea Fr.
**Collybia abundans* Pk.
Collybia butyracea Fr.
**Collybia confluens* Fr.
Collybia dryophila Fr.
Collybia familia Pk.
***Collybia myriadophylla* Pk.
***Collybia platyphylla* Fr.
***Collybia radicata* Fr.
Collybia strictipes Pk.
**Collybia zonata* Pk.

Collybia conigenoides Ellis. This is apparently a good species. Bresadola in Fung. Trid. II. p. 48 and 86, gives spore measurements of *C. esculenta* Wulf. and *C. conigena* Pers. as oblong, 6–8 × 3–4 μ. The Tennessee species is quite common on fallen and old Magnolia cones. Pileus 6–12 mm. broad, whitish or "cinnamon-buff" (Ridg.), striate; gills adnexed, close; stems elongated where they arise from buried cones, and hairy as in *C. conigena*, almost filiform, toughish and flexuous; spores ovoid, white in mass, smooth, 4–5.5 × 3 μ; cystidia ventricose, scattered on sides of gills, 45–55 × 12–15 μ, more abundant and flask-shaped on the edges, causing the pruinosity of the gills.

Cantherellus cinnabarinus Schw.
***Cantherellus cibarius* Fr.
Cantherellus floccosus Schw.
Cantherellus tubaeformis Fr.
Clitocybe cyathiformis Fr.
Clitocybe ectypoides Pk.
Clitocybe illudens Schw.
Clitocybe laccata Fr.
Clitocybe ochropurpurea B. & C.
Clitocybe piceina Pk.
Cortinarius alboviolaceus Fr.
Cortinarius bolaris Fr.
Cortinarius corruscans Fr.
Cortinarius flavifolius Pk.
Cortinarius infractus Fr.
Cortinarius hemitrichus Fr.
Cortinarius largus Fr.
Cortinarius lilacinus Pk.
Cortinarius rigens Fr.
Cortinarius torvus Fr.
Crepidotus applanatus Fr.

Claudopus variabilis Fr. In exact agreement with the description of Fries. *C. depluens* has angular spores, but Ricken seems to have confused the two species. Spores 10–12 × 5–6 μ, ellipsoid.

Clitopilus abortivus Fr.
Clitopilus orcella Fr.
Entoloma clypeatum Fr.
Entoloma griseum Pk.
Entoloma sericellum Fr.
Entoloma sericatum Britz.
Entoloma speculum Fr.
Hebeloma crustuliniforme Fr.
Hygrophorus ceraceus Fr.
Hygrophorus chlorophanus Fr.
***Hygrophorus marginatus* Pk.
Hygrophorus miniatus Fr. and var. *squamulosus* Pk.
Hygrophorus Peckii Atk.
Hygrophorus pratensis Fr.
Hygrophorus psittacinus Fr.
***Hypholoma capnoides* Fr. var. *alleghaniensis* var. nov.
Inocybe Cookei Bres.

Inocybe destricta Fr.
Inocybe geophila Fr.
Inocybe pallidipes E. & E.
Inocybe praetervisa Quél.
Inocybe rimosa Fr.
Inocybe subochracea var. *Burtii* Pk.
Inocybe trechispora Berk.
Lactarius alpinus Pk.
Lactarius cinereus Pk.
*******Lactarius corrugis* Pk.
***Lactarius griseus* Pk.
Lactarius lignyotus Fr.
***Lactarius piperatus* Fr.
Lactarius Peckii Burl.
Lactarius subdulcis Fr.
Lactarius subpurpureus Fr.
Lactarius theiogalus Fr.
Lactarius trivialis Fr.
Lactarius volemus Fr.
Lepiota acutaesquamosa Fr.
Lepiota adnatifolia Pk.
Lepiota asperula Atk.
**Lepiota cepaestipes* Fr.
Lepiota clypeolaria Fr.
Lepiota granosa Morg.
Leptonia lampropoda Fr.
**Marasmius resinosus* Fr.
***Marasmius siccus* Schw.
Mycena cohaerens Fr.
Mycena epipterygia Fr.
**Mycena Leaiana* B. & C.
Mycena sanguinolenta Fr.
Nolanea dysthales (Pk.).
***Panus angustatus* Berk.
***Panus stipticus* Fr.
Panaeolus solidipes Pk.
***Paxillus corrugatus* Atk.
Paxillus panuoides Fr.
Paxillus rhodoxanthus Schw.
Pholiota aggericola Pk.
Pholiota flammans Fr.
Pholiota lutea Pk.
***Pholiota squarrosoides* Pk.
**Pleurotus applicatus* Fr.
***Pleurotus sapidus* Fr.
***Pluteus cervinus* Fr.
Pluteus nanus Fr.
***Psalliota placomyces* Pk.
***Psathyrella disseminata* Fr.
Russula delica Fr.
***Russula emetica* Fr.
***Russula fragilis* Fr.
Russula foetens Fr.
Russula flavida Frost.
Russula flava Romell.
Russula ochrophylla Pk.
Russula squalida Pk.
**Russula uncialis* Pk.
Russula variata Banning.
Russula virescens Fr.

Russula ochroleucoides sp. nov.

Pileus 6–12 cm. broad, large, rigid, convex, soon expanded plane, varying straw-yellow to pale-ochraceous, usually dull-ocher to reddish-ocher toward center, pellicle adnate, soon dry and pulverulent to subrimose, even on the obtuse margin; flesh thick, compact, white, unchanging or slightly sordid in age; gills adnexed or free, rather narrow, rounded and broader in front, white or whitish, close to subdistant, shorter ones intermingled, often forked behind, intervenous; stem 4–6 cm. long, 1.5–2 cm. thick, short, rigid, equal or tapering slightly downward, white, glabrous or subpruinose, spongy-solid; spores even or minutely rough, 7–9 μ (incl. apiculus), white in mass; cystidia very few; basidia about 40 $\times$ 9 μ; taste tardily and slightly bitterish-acrid to disagreeably bitter; odor faintly aromatic or none.

Gregarious, on the ground in woods of deciduous trees. Infrequent. Elkmont, Tennessee, and Ann Arbor, Michigan. This seems to be a rather rare species and was found only three times. Although similar to *R. ochroleuca* in colors, it departs widely by belonging to the Rigidae, near *R. virescens.*

***Schizophyllum commune* Fr.

Stropharia caesiospora sp. nov.

Pileus 4–9 cm. broad, convex, obtuse, chamois to honey-yellow (Ridg.), subviscid, even, firm or slightly elastic, margin somewhat crenate-lobed; flesh white, rather thick and compact, thin on margin; gills crowded, narrow, adnexed-emarginate, at length rounded behind, heterophyllous, drab to hair-brown or ashy-gray; stem 4–9 cm. long, equal or slightly bulbous at the base, whitish, 6–12 mm. thick, slightly lacerate above the annulus, stuffed to solid, fibrillose-glabrescent; annulus persistent, membranous, flocculose below, striate-ridged above, becoming gray from the spores; spores minute, 5–6 × 3–4 μ, ovoid, smooth, tinged purplish-cinereous under microscope, ashy in mass with a tint of purple; cystidia none, except few, inflated, sterile cells on edge of gills; odor slight.

Gregarious, on the ground among debris in chestnut and conifer mixed woods, Elkmont, Tennessee, September, 1916. The color of the half-mature gills is similar to that of *S. depilata* Fr., but paler. The annulus has the markings of *S. coronilla* Fr. and of *S. bilamellata* Pk., which differ in spore-size. It is near to the description of *S. obdurata,* which Ricken considers identical with *S. coronilla.* It was found a number of times.

Tricholoma album Fr.
Tricholoma personatum Fr.
Tricholoma rutilans Fr.
Tricholoma sejunctum Fr.
Tricholoma sulphureum Fr.

TREMELLALES

Tremella albida Huds.
Tremellodon gelatinosum Fr.
Calocera viscosa Fr.

GASTEROMYCETES

Astraeus stellatus (Scop.) E. Fischer
Calostoma cinnabarinus Desv.
Calvatia cyathiforme (Bosc).
Cyathus striatus (Huds.) Hoff.
**Geaster triplex* Jung.
Geaster saccatus Fr.
Lycoperdon gemmatum Batsch.
Lycoperdon pyriforme (Schoeff.) Fr.
***Lycoperdon subincarnatum* Pk.
Scleroderma Geaster Fr.
**Scleroderma tenerum* Berk.
***Scleroderma vulgare* Fr.

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NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—I

TYÔZABÛRO TANAKA

This is the first of a series of papers prepared for the purpose of supplying prompt and full information regarding newly discovered Japanese fungi that have been described only in Japanese. Descriptions of new species of fungi, many of them of great economic importance, are appearing in many different publications in Japan, some of them difficult to obtain in the United States. New species which are published in Latin, English, or other European language will be merely cited if referred to at all. It is hoped that the information here presented will prove of interest and value to American and European mycologists and plant pathologists.

There are two lists of Japanese fungi published twelve and thirteen years ago, both including all species known from Japan at the time, one by Prof. J. Matsumura, Index plantarum japonicarum, Vol. 1. Cryptogamae (Fungi pp. 127–184) 8°, Tokyo Mar. 1904, giving an alphabetical list of species with synonomy, host plants and localities all in Latin; the other by Prof. M. Shirai, A List of Japanese Fungi hitherto known, 8°. Tokyo Nov. 1905, 156 pp., giving an alphabetical list of species with synonomy in Latin and the host plants in Japanese characters only. Localities are not given. The more important fungi causing plant diseases in Japan are treated by Prof. A. Ideta, Handbook of the Plant Diseases of Japan, 4 ed. 4°, Tokyo 1909–1911, 1104 pp. A 17-page index gives the Latin names of the fungi treated. Prof. Ideta is now writing a supplement bringing this work up to date.

VALSA (EUVALSA) PAULOWNIAE Miyabe and Hemmi, sp. nov. in Byôchû-gai Zasshi (Journal of Plant Protection) 3^{9}: 681–689. 1 pl. Sept., 1916. (Japanese.)

This fungus attacks the Paulownia tree first on the twigs and

then spreads over the branches, finally covering the entire tree down to the roots. The infection occurs in winter and early spring, mostly on the wounded or dead part of shoots, which gradually become rough, dry and brown, and finally crack with irregular elevated spots appearing on the surface—the stromata of the fungus. Loose mycelia from the stroma connect the tissues of the host and the fungus bodies. The pycnidia first appear on the stromata as depressed globular flasks, 1.5 × .6 mm., with colorless, obtuse, slightly curved pycnospores 2.85–8.75 × 0.88–1.75 μ on short, branched conidiophores. The perithecia, arranged at the bottom of stroma, 15–16 in one group, are flask-shaped with long necks about twice or three times the length of the perithecial body which measures 150–300 μ in diameter; asci very fragile, soon disappearing, cylindric or clavate, more or less curved, sessile or very short stalked, 32–52 × 8–10 μ octospored; ascospores generally in two rows, occasionally irregular or one row, cylindric, obtuse, curved, smooth, hyaline, very slightly pale brownish when mature, 10–18 × 2–4 μ, germinating in 20–24 hours, either in distilled water or on culture media.

This "Tachigare" or dieback disease first appeared in Hokkaidô about 1910 and seriously damaged Paulownia, first in 1913 and 1914 when many old trees were killed. In 1915 the disease spread all over Hokkaidô, and in one case about 3,000 trees at the same place were attacked.

For its prevention the trunks of the trees should be wrapped with straw in winter so as to prevent freezing or wounding. Bordeaux mixture should be used as a spray on the trees in early spring.

OPHIOCHAETA GRAMINIS (Sacc.) K. Hara n. comb. in Byôchû-gai Zasshi (Journ. of Plant Protection) 3^5: 342–345. May, 1916. (Japanese.)

This fungus, commonly called *Ophiobolus graminis,* is known as a cause of foot-rot of wheat and barley in France, Belgium, Germany, and Japan. The author discovered a similar disease on rice-plant caused by the same fungus which he proposes to transfer to Saccardo's genus Ophiochaeta, on account of the existence of bristle hairs on the perithecium. In the case of the fungus attacking the rice-plants the perithecia are somewhat smaller, *i. e.,* 240–480 μ diameter, and the ostiolum 12–280 μ in length and 7–8 μ across, but the asci and ascospores are nearly the same as described from other plants, *i. e.,* asci 80–120 × 8.5–16 μ and ascospores 27.1–104 × 3.2–4 μ.

The author suggests four important factors in preventing the disease: (1) Selection of a resistant variety; (2) necessity of avoiding the use of too much nitrogen fertilizers; (3) not allowing too much water on the field; and finally (4) application of stable manure instead of mulching the field.

MARSONIA CARTHAMI T. Fukui sp. nov. in Nôgaku Kwaihô (Journ. of the Scientific Agricultural Society) No. 166, pp. 381–383, fig. 6. T. 5, vi. June, 1916. (Japanese.)

Spots ochre-brown, few, 1–10 rarely more, orbicular, elliptical or irregular, never angular, varying in size, the largest 10×6 mm., sometimes confluent, forming still larger spots, margin definite, raised, punctate with acervuli; acervuli subepidermal, scattered, brownish; conidiophores hyaline or pale yellowish, $20 \times 3\,\mu$; conidia hyaline or pale yellowish-brown, elliptic, ends acute especially the base, giving a fusiform appearance, contents granular at maturity, 1-septate, constricted at the septum, $10–25 \times 4–6\,\mu$, average $20 \times 5\,\mu$.

On living leaves of young plants of *Carthamus tinctorius* L. (Compositae) called in Japan *Benibana* (*Hung-hua,* in Chinese) found at the experiment farm of Shidzuoka-ken Agr. Experiment Station, Abegun, Shidzuoka-ken, Japan: Sept. (?), 1916.

MYCOSPHAERELLA HORDICOLA Hara sp. nov., ex Tsuruda, Shôitsu in Byôchû-gai Zasshi (Journ. of Plant Protection) 3^7: 532. July, 1916. (Japanese.)

Perithecia small, black, globular, $297 \times 212\,\mu$ or $255 \times 212\,\mu$ (figures doubtful); asci irregularly cylindrical or sometimes conical, octosporous; spores hyaline, fusiform, blunt at both ends, $7–15 \times 2.7–3.5\,\mu$, two-celled, contents granular. On the blades and culms of wheat, barley, and naked barley,

Differs from *Sphaerella bacicola* B. Frank which grows on rye and has perithecia with rosy interior and constricted elliptical spores which measure $10–12\,\mu$. This sp. is also distinct from *Mycosphaerella Hordei* Karst which has straight, elliptical or fusiform constricted spores, $18–24 \times 6–8\,\mu$.

Distribution: Shidzuoka-ken, Suntô-gun, Kanaoka-mura, May 24, 1916, S. Tsuruda; Agehara-mura, May 3, 1916, S. Tsuruda; Ukishima-mura, May 11, 1913, S. Tsuruda; Fuji-gun, Obuchi-mura, June 22, 1915, Takimura Nôkwai (Agr. Soc. of Taki-

mura); Inasa-gun, Iinoya-mura, April 13, 1914, S. Tsuruda; Aratama-mura, May, 1914, T. Okada.

New Japanese name of the disease: Mugi no Kangare-byô (Culm-rot disease of barley and wheat).

Local name of the disease: Mugi no Tachigare (Foot-rot or stem-rot of barley and wheat); Kuse (Bad-habit).

Notes: A barley variety "Dobu" seems resistant to the disease; on the other hand the variety "Oku-mikawa" is very susceptible. The disease is much less injurious when seeds are sown earlier than the usual planting time. The disease becomes virulent when nitrogenous fertilizers are used too freely. Phosphate is effective in strengthening the growth of the culm to withstand the disease. Lime, sulphur-flower, and Bordeaux mixture all lessen the damage done by this fungus.

SCORIAS CAPITATA K. Sawada sp. nov. in Nôjishikenjô Tokubetsu Hôkoku (Special Report, Agr. Exp. Station) Taiwan (Formosa), No. 11, pp. 123–124, pl. 4, fig. 19–23. T. 4, ii, Feb., 1915. (Japanese.)

Mycelia covering the upper surface of the leaves of *Thea sinensis* as a black mass, sometimes covering the lower surface and even the twigs, presenting a conspicuously rough or fuzzy appearance, which is caused by bundles of hyphae and slender perithecia which stand upright. Hyphae catenulate, soot color, 2.5–5 μ across; hyphae bundles (perithecial stalks) soot color, once or twice branched, of various forms but usually conical, cylindrical, fusiform or elliptical, frequently two joined together at the lower half, 110–247 $\times$ 52–75 μ, apically constricted terminated by perithecia; perithecia black, nearly ovate or orbicular, 60–83 $\times$ 50–78 μ, containing numerous asci; asci clavate, obtuse, hyaline, 30–35 $\times$ 9–12 μ, with 6–8 spores; spores fusiform to clavate-fusiform, obtuse at both ends, hyaline, 3-septate, 10–11.5 $\times$ 3–3.5 μ.

Type locality: Taihokuchô Chônaiho-shô, Formosa. Dec. 12, 1907, Y. Fujikuro.

ZUKALIA THEAE K. Sawada sp. nov. in Nôjishikenjô Tokubetsu Hôkoku (Special Report Agr. Exp. Station) Taiwan (Formosa) No. 11, p. 122, pl. 4, figs. 10–13. T. 4, ii, Feb., 1915. (Japanese.)

Perithecia black, globose, 67–135 μ in diameter; subiculum black,

hyphae filiform, at first pale, later brownish, branched, septate, 3–6 μ across; asci many, surrounded by 6–8 dark brown, blunt, 5–6-septate setae, 70–100 × 4 μ; asci 8-spored, hyaline, clavate, fusiform, 68–90 × 13–16 μ; spores hyaline, obovate elliptic to clavate, 3-septate, 17–23 × 6–7 μ.

On leaves and twigs of *Thea sinensis*.

Type locality: Shinchiku-chô, Sanshaka, Formosa, May 10, 1910, K. Sawada.

PESTALOZZIA THEAE K. Sawada sp. nov. in Nôjishikenjô Tokubetsu Hôkoku (Special Report Agr. Exp. Sta.), Taiwan (Formosa), No. 11, p. 113, pl. 4, figs. 7–9. T. 4, ii, Feb., 1915. (Japanese.)

Spots punctate with acervuli; acervuli at first subepidermal, later erumpent, finally exposed; mycelium penetrating the host, hyaline, branching, 2.5–3 μ in diam., mycelial tissue thin but composed of tightly woven hyphae; conidiophores caespitose, simple, short, filiform, 4–9 × 1 μ, fugacious; conidia fusiform, 4-septate, slightly constricted, 3 inner cells dark brown, 16–21 μ, basal and apical cells hyaline, 4–6 μ, setae 3–4, 28–36 × 1–2 μ, slightly swollen at the apex, hyaline.

On leaves of *Thea sinensis*. Diseased spots brown when young, when mature gray with brown margin, usually 1 cm. in diam., sometimes covering half of a leaf. Acervuli always appear on the concentric zone as black dots, but when they occur on the under surface of leaves, the zones are not always distinct and the dots are very few.

Type localities: Taihokuchô Zuihô, Jul. 4, 1909, Y. Fujikuro; Taihokuchô Kusshaku, Jul. 14, 1908, Y. Fujikuro; Taihokuchô Mokusaku, Sept. 30, 1908, Y. Fujikuro: Taihokuchô Shinten, Jul. 15, 1908, Y. Fujikuro; Taihokuchô, Rigyokutsu, Jul. 13, 1908, Y. Fujikuro; Taihokuchô, Hokuseiko, Jul. 9, 1907, R. Suzuki; Taihokuchô Chônaiho, Dec. 19, 1908, K. Sawada; Nov. 30, 1909, Y. Fujikuro, May 4, 1910, K. Sawada; Tôenchô Kessishô, Aug. 21, 1908, K. Sawada & Y. Fujikuro; Tôenchô Dôraken, Aug. 21, 1908, K. Sawada & Y. Fujikuro; Tôenchô Anheichin, Aug. 20, 1908, K. Sawada & Y. Fujikuro; Shinchikuchô Shinpo, May 6, 1910, Y. Fujikuro; Akôchô Kôkô, Jul. 8, 1910, K. Sawada.

SCLEROTINIA FAGOPYRI S. Hori sp. nov. in Byôchû-gai Zasshi (Journ. Plant Protection) 3^3: 171–175. Mar. 1916. (Japanese.)

Sclerotia orbicular, ellipsoid, oblong or ovoid, 2–3 × 2–4 mm., surface black, inner tissue rose colored; apothecia one or two from a sclerotium, cinnamon-brown, 3 mm. in diam., somewhat cupulate, stipitate, stipes 3–5 mm. in length; asci cylindrical, slightly curved, 135–155 × 9–11 μ; ascospores eight, obliquely monostichous, 11–14 × 6–8 μ, guttulate near each end; paraphyses filiform or clavate, slightly longer than the asci, 2–2.5 μ in diam., 2–4 (usually 2–3) septate.

The sclerotia form inside of the seeds of *Fagopyrum esculentum* and probably germinate twice a year. The diseased seeds sink in brine of 1.12 to 1.20 sp. gr., while healthy seeds float. They alone should be planted.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

NOTES AND BRIEF ARTICLES

Professor L. H. Pennington, of Syracuse University, visited the Garden on April 9 to consult the library and mycological herbarium.

Forsythia viridissima is subject to a disease of the flower stalks which, according to Peglion, is probably due to *Sclerotinia libertiana.*

A new disease of bamboo found by Turconi on the branches of *Bambusa mitis* in the botanical garden at Pavia is said to be due to *Melanconium Bambusae* sp. nov.

We are requested by Mr. E. Bartholomew to announce that the publication of "Fungi Columbiani" has been discontinued with the distribution of Century 51.

Professor H. S. Jackson, of Purdue University, Lafayette, Indiana, spent the week of April 16–21 at the Garden working on plant rusts in preparation of manuscript for a forthcoming part of *North American Flora.*

Professor Frederick E. Clements has resigned the chair of botany at the University of Minnesota to accept a position with the Carnegie Institution of Washington.

Mr. Ray Nelson, formerly assitant in the Michigan Agricultural College Experiment Station, has been appointed plant pathologist for the Illinois Central Railroad.

Mr. W. P. Fraser, plant pathologist of Macdonald College, has been appointed to investigate the problem of grain rust on the prairie provinces of Western Canada.

Professor C. H. Kauffman, of the University of Michigan, Ann Arbor, Michigan, spent several days at the Garden about the

middle of April studying the collections of *Inocybe* in preparation for the publication of this genus in *North American Flora.*

Mr. Lex Hesler, of Cornell University, has been granted a year's leave of absence to study plant diseases in Porto Rico. He sailed for Mayagüez on February 10.

Mr. H. E. Thomas, instructor in botany at the Virginia Polytechnic Institute, sailed on March 3, to Mayagüez, to take up work in plant pathology at the Federal Experiment Station, Porto Rico.

A wilt disease of the columbine has been traced by Taubenhaus to *Sclerotinia libertiana,* which attacks the crown and then the stem of the plant. The fungus winters over on dead plants, which show the sclerotia in large numbers.

Mr. C. G. Lloyd, of Cincinnati, has presented to the Garden a complete set of all known species of puffballs, based on his extensive and long-continued studies of this group. The value of this contribution can hardly be estimated.

Botryorhiza Hippocrateae and *Endophylloides portoricensis,* new genera and species of rusts, were described by E. W. Olive and H. H. Whetzel in the January number of the *American Journal of Botany* in an article on the *Endophyllum*-like rusts of Porto Rico.

L. M. Massey, in the Cornell University Agricultural Experiment Station Bulletin 380, gives the results of his rather extensive studies of the hard-rot disease of *Gladiolus* caused by *Septoria Gladioli* Passer. The methods of treating the disease are also considered.

Phymatotrichum omnivorum is the name used by Dr. B. M. Duggar for the fungus causing the cotton root rot which is common in many parts of Texas. An account of this disease was recently published in the *Annals of the Missouri Botanical Garden.*

Among fungi collected recently in China by Mr. Frank N. Meyer are specimens of *Cryptoporus volvatus* found on a dead trunk of *Pinus sinensis* at Ching lung shan, Chili Province. This interesting species has previously been collected in Japan.

Five new species of *Ravenelia* from Texas, Arizona, and Florida were recently published by W. H. Long in the *Botanical Gazette.* These species are as follows: *Ravenelia annulata, R. morongiae, R. reticulatae, R. roemerianae,* and *R. thornberiana.*

Dr. E. A. Burt has recently completed a study of the Thelephoraceae collected by W. A. Murrill in Mexico, and reports many interesting species, quite a number of which are new. These will be published in Dr. Burt's series of articles now appearing in the *Annals of the Missouri Botanical Garden.*

Helicosporium nymphaearum is described as new by Frederick V. Rand in the February number of the Journal of Agricultural Research. The fungus causes irregular spotting and decaying of the leaves of various species of pond lilies of the genus *Nymphaea.* Part of the material on which these studies were based was collected in the New York Botanical Garden, although the disease was first noted at Kenilworth, D. C.

Sorauer has recently made observations on house plants and finds that injury from burning gas in rooms is negligible and is easily avoided entirely by ventilation. The chief injuries are probably due to the elevation of temperature and the drying of the atmosphere by means of fires or heaters.

Pistillaria Thaxteri Burt, recently described as the smallest hymenomycete, was found by Professor Thaxter on rotten wood at Westhaven, Connecticut, about twenty-nine years ago. An account of this interesting little fungus appeared in the *Annals of the Missouri Botanical Garden* for November, 1916.

The genus *Hypochnus* is treated by Dr. E. A. Burt in the *Annals of the Missouri Botanical Garden* for April, 1916, 31

North American species being recognized, of which 13 are new and many are newly combined. The genus *Septobasidium* treated in the September number of the same volume contains 17 North American species, of which 10 are new.

Mushroom fairy rings of *Tricholoma praemagnum* found at several places in Colorado by Francis Ramaley were described and figured in *Torreya* for September, 1916, which number also contains a redescription of the species by L. O. Overholts. This large and interesting agaric was first described in *North American Flora* from Saskatchewan, Canada.

Entoloma cinchonense Murrill, described from Cinchona, Jamaica, in Mycologia **3**: 279. 1911, has been found to have hyaline spores and is therefore here newly combined as **Melanoleuca cinchonensis** Murrill. It is readily distinguished from other tropical American species of this genus by its small, ochroleucous pileus and salmon-colored, notched lamellae.

Professor George Massee, the well-known English mycologist, died on February 17 at the age of sixty-seven. Professor Massee was long connected with the Royal Botanic Garden at Kew and published many books and papers on mycology. His private collection of fungi and drawings was purchased by the New York Botanical Garden some years ago. He has been one of the associate editors of *Mycologia* since 1911.

Mr. Sanford M. Zeller has made an extensive physiological study of *Lenzites saepiaria* Fries with special reference to enzyme activity. An interesting experiment by Mr. Zeller shows that *L. saepiaria* will grow well on 50 per cent. resin by weight, which is considerably more than is found in any coniferous wood, and that growth of the fungus is not entirely inhibited by 85 per cent. resin.

Fine specimens of the common mushroom have been sent in by Dr. S. M. Stocker, of Duluth, Minnesota, exhibiting abnormal outgrowths of the fruiting surface on the top of the cap. The inverted hymenium is in many cases not strictly lamellate but

somewhat poroid and otherwise abnormal. This peculiarity is often exhibited by *Tricholoma personatum* and certain other wild agarics.

Dr. C. L. Shear visited the Garden on February 3 to consult the library and mycological collection. He then went with Professor J. C. Arthur to Philadelphia to examine the Schweinitz collection of fungi to determine how it might be made more available to American mycologists. Dr. Shear and Dr. Arthur are members of a committee appointed for this purpose by the American Phytopathological Society.

Mel T. Cook and G. W. Wilson have been investigating the effect of tannin on the growth of the chestnut canker fungus and they find that 0.8 per cent. or more causes a retardation of germination, which is frequently followed by an abnormal stimulation of the growth of the aerial mycelium. It was found that tannin is utilized by *Endothia parasitica,* the fungus being able to remove as much as 2 per cent. from the substratum.

Professor Ellsworth Bethel, of the State Museum, Denver, Colorado, has recently sent in a specimen of *Scutiger cryptopus,* which is the first I have seen from Colorado, the species having been found heretofore in Kansas and Nebraska, attached to dead grass roots in sandy pastures. The specimen sent by Professor Bethel grew in a field at Boulder, Colorado. Other specimens sent at the same time included *Lentodium squamosum, Polyporus elegans,* and *P. arcularius.*

Mr. E. D. Merrill, of the Bureau of Science, Manila, has recently sent to the Garden specimens of *Pachyma hoelen* Fries, purchased in a Chinese drug store in Hongkong by Mr. Tutcher, Director of the Hongkong Botanic Garden. This fungus is extensively cultivated on pine trees in central China. The following description by Fries was based on *Hoelen* of Rumphius, which was described from Chinese specimens.

"3. Hoelen. *Sinensium.* Oblongum, cortice rugoso, extus intusque sordide flavescens.

"Magnitudo capitis infantis. Medicamentum pretiosum, Theae instar, ad vires corrobandas, in Phtisi &c., usitatum. *Sub terra arenosa in China, provincia* Suchensi."

Farmers' Bulletin 789 of the U. S. Department of Agriculture treats of certain insects that attack mushrooms and the means of controlling them. The chief insects considered are maggots, mites, springtails, and sowbugs, the first class being the most important. The author, C. H. Popenoe, concludes that if the mushroom house is carefully constructed and all outlets closed or screened; if the spawn is purchased from reliable dealers; and if the compost is carefully prepared and kept at as low a temperature as possible, there should be little necessity for the radical measures of fumigation, sterilization, or destruction of the mushroom beds.

The report of the New York State Botanist for 1915 contains descriptions and notes of many new and interesting species of fungi, especially of those parasitic on leaves and twigs. Dr. House has been assisted by Professor Dearness in this publication. The following species are new: *Cercospora caricis, C. lathyri, Cucurbitaria ceanothi, Diaporthe minuta, Gloeosporium alnicola, G. falcatum, G. hydrophylli, Macrophoma viburni, Metasphaeria staphyleae, M. varia, Microdiplodia ceanothi, M. lophiostomoides, Phoma florida, P. galactis, P. linariae, P. pectinata, P. platanicola, Phyllosticta steironematis, Ramularia cichorii, Scolescosporium coryli, Septoria mollisia, S. tenuis, Sphaeropsis ceanothi, S. parallela, S. viburni-dentati, Stagonospora convolvuli, Dothidella vacciniicola.*

Three new polypores have just been published by W. H. Long in the first number of the *Papers of the New Mexico Chapter Phi Kappa Phi. Polyporus pseudosulphureus* was collected on live oak near Ocala, Florida, as well as from three other localities in Florida on the same host. *Fomes arctostaphyli,* which is said to be the smallest species of this genus with brown context yet reported from North America, was collected abundantly on *Arctostaphylos* at various places in Arizona. The author says it is very

common on manzanita in the vicinity of Sedona, where it attacks practically every bush of this host which is over an inch in diameter, causing a very characteristic heart-rot. *Polyporus pini-ponderosae* was collected on *Pinus ponderosa* near Albuquerque, New Mexico. It should be carefully compared with *Tyromyces Smallii* Murrill, which occurs on pine in Florida and Louisiana.

Melanoleuca pulverulentipes Murrill, sp. nov.

Pileus rather thick, convex to plane, becoming slightly umbilicate, solitary, 1.5–1.7 cm. broad; surface moist, hygrophanous, smooth, glabrous, somewhat mottled, fulvous, becoming isabelline on drying, margin incurved, frosted, entire, concolorous; lamellae sinuate, plane, crowded, ferruginous-melleous to ochroleucous, entire and concolorous on the edges; spores ellipsoid, smooth, hyaline, 5×2–$3\,\mu$; stipe subequal, tough, smooth, pale-fulvous or ochroleucous, finely pulverulent-fibrillose and ochraceous-melleous at the apex, whitish-mycelioid at the base, 1.5–2 cm. long, 2–4 mm. thick.

Type collected on the ground among mosses in woods at Lake Placid, Adirondack Mountains, New York, July 17–29, 1912, *W. A. & Edna L. Murrill 181* (herb. N. Y. Bot. Gard.).

HABITAT: On the ground in humus or among mosses.

DISTRIBUTION: Vicinity of Lake Placid, Adirondack Mountains, New York.

W. A. MURRILL.

THE ROSY-SPORED AGARICS

Volume 10, part 2, of *North American Flora*, by William A. Murrill, appeared April 25, 1917. The contents of this part may be indicated, as follows:

Genera	Total North American Species	New Species
Claudopus	9	1
Eccilia	25	9
Leptoniella	43	14
Nolanea	28	11
Pleuropus	30	5
Lepista	4	
Entoloma	63	34
Pluteus	57	30
Chamaeota	2	1
Volvariopsis	21	2
	282	107

For the accommodation of those preferring currently accepted generic names, the following new combinations are proposed for species described as new in *Leptoniella, Pleuropus, Chamaeota,* and *Volvariopsis:*

LEPTONIELLA ACERICOLA	= **Leptonia acericola**
LEPTONIELLA ALABAMENSIS	= **Leptonia alabamensis**
LEPTONIELLA ALBIDA	= **Leptonia albida**
LEPTONIELLA FULIGINOSA	= **Leptonia fuliginosa**
LEPTONIELLA GLABRA	= **Leptonia glabra**
LEPTONIELLA MULTICOLOR	= **Leptonia multicolor**
LEPTONIELLA MURINA	= **Leptonia murina**
LEPTONIELLA NIGRA	= **Leptonia nigra**
LEPTONIELLA OCCIDENTALIS	= **Leptonia occidentalis**
LEPTONIELLA ROSEIBRUNNEA	= **Leptonia roseibrunnea**
LEPTONIELLA SEMIGLOBATA	= **Leptonia semiglobata**
LEPTONIELLA SUBPLACIDA	= **Leptonia subplacida**
LEPTONIELLA SUBVILIS	= **Leptonia subvilis**
LEPTONIELLA UMBILICATA	= **Leptonia umbilicata**
LEPTONIELLA WHITEAE	= **Leptonia Whiteae**
PLEUROPUS ADNATIFOLIUS	= **Clitopilus adnatifolius**
PLEUROPUS AVELLANEUS	= **Clitopilus avellaneus**
PLEUROPUS CINEREICOLA	= **Clitopilus cinereicola**
PLEUROPUS LIGNICOLA	= **Clitopilus lignicola**
PLEUROPUS MAGNISPORUS	= **Clitopilus magnisporus**
PLEUROPUS MURINUS	= **Clitopilus murinus**
PLEUROPUS OBESUS	= **Clitopilus obesus**
PLEUROPUS SUBCINEREUS	= **Clitopilus subcinereus**
CHAMAEOTA BROADWAYI	= **Annularia Broadwayi**
VOLVARIOPSIS ALABAMENSIS	= **Volvaria alabamensis**
VOLVARIOPSIS EARLEAE	= **Volvaria Earleae**

Through an unfortunate error, *Leptoniella Earlei* was used for two distinct species. For the one on p. 90, **Leptoniella paludosa** nom. nov. is here proposed, or, for those following Saccardo, **Leptonia paludosa** comb. nov.

W. A. MURRILL.

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ILLUSTRATIONS OF FUNGI

MYCOLOGIA

VOL. IX JULY, 1917 NO. 4

ILLUSTRATIONS OF FUNGI—XXVI

WILLIAM A. MURRILL

The rosy-spored gill-fungi of North America have recently been monographed in volume 10, part 2, of *North American Flora,* and a summary of the genera and species was published in the last number of *Mycologia.* The accompanying plate represents in their natural colors several species of this interesting group. The original drawings of figures 2, 3, and 7 were made several years ago in Maine by Miss Violette S. White; figure 6 is from a recent sketch by Dr. H. D. House; and the other figures are from originals by Miss Eaton. Other rosy-spored species have been previously illustrated in this series, as follows: *Claudopus nidulans* in Mycologia **6**: *pl. 113, f. 6; Entoloma Grayanum* in Mycologia **5**: *pl. 92, f. 4; Lepista personata* in Mycologia **2**: *pl. 19, f. 1; Lepista tarda* in Mycologia **6**: *pl. 113, f. 4; Pleuropus abortivus* in Mycologia **4**: *pl. 56, f. 12;* and *Pluteus cervinus* in Mycoolgia **1**; *pl. 3, f. 2.*

Entoloma commune Murrill

COMMON ENTOLOMA

Plate 7. Figure 1. × 1

Pileus rather thin, convex, often umbonate, becoming depressed and irregular with age, gregarious to subcespitose, 3–5 cm. broad; surface dry, polished, glabrous, avellaneous-umbrinous, usually darker on the umbo, the cuticle often cracking radially with age, margin concolorous, irregular, usually lobed or split in large specimens; context thin, white, with farinaceous

[MYCOLOGIA for May (9: 129–184) was issued June 9, 1917.]

odor and taste; lamellae more or less sinuate, rather narrow, not crowded, soon becoming rose-colored; spores decidedly angular, apiculate, uniguttulate, rose-colored, copious, 6–8 μ; stipe equal, rather short, often twisted, pruinose at the apex, polished and asbestos-like below, white or pale-avellaneous, 4–5 cm. long, 3–6 mm. thick.

Common about New York City, and found on the ground in woods from New England to the mountains of Virginia.

Leptoniella grisea (Peck) Murrill

GRAY LEPTONIELLA

Plate 7. Figure 2. × 1

Pileus broadly convex or plane, umbilicate, 1.2–2.5 cm. broad; surface striatulate when moist, grayish-brown, glabrous, except on the umbilicus, which is squamulose; lamellae broad, subdistant, grayish; spores subglobose, angular, uninucleate, 7.5–10 μ; stipe slender, hollow, glabrous, concolorous, 3.5–6 cm. long, 2 mm. thick.

A rare species found among sphagnum or in humus in wet woods in Maine and New York.

Entoloma salmoneum Peck

SALMON-COLORED ENTOLOMA

Plate 7. Figure 3. × 1

Pileus thin, conic or campanulate, subacute or with a minute papilla or small cusp at the apex, gregarious, 1.5–3 cm. broad; surface glabrous, moist, salmon-colored, margin sometimes uneven or lobed; lamellae broad, subdistant, ventricose, salmon-colored; spores subglobose, angular, 10–12.5 μ in diameter; stipe slender, equal, glabrous, hollow, concolorous, 7.5–15 cm. long, 2–4 mm. thick.

This beautiful species is frequent in dense woods from New England to Ohio. Dr. Peck selected an excellent name for it.

Entoloma tortipes Murrill

TWISTED-STEMMED ENTOLOMA

Plate 7. Figure 4. × 1

Pileus convex to subexpanded, with a small, conspicuous, conic umbo, rather thin and fragile, reaching 3 cm. broad; surface smooth, with a satiny gloss, rosy-isabelline, margin concolorous, entire, sometimes splitting with age; context very thin, pallid; lamellae sinuate, of medium breadth, subcrowded, slightly ventricose and rounded behind, entire on the edges, pallid to rose-colored; spores ellipsoid, angular, uniguttulate, usually apiculate, rose-colored, 9–11 × 5–7 μ; stipe decidedly tapering upward, conspicuously twisted, smooth, glabrous, polished, white or pale-avellaneous, solid, 6–7 cm. long, 3–6 mm. thick.

Known only from a single collection taken from an old deciduous stump in the New York Botanical Garden.

Entoloma inocybiforme Murrill

INOCYBE-LIKE ENTOLOMA

Plate 7. Figure 5. × 1

Pileus fleshy, fragile, convex to deeply depressed and irregular with age, distinctly umbonate, loosely clustered, abundant, 4–6 cm. broad; surface hygrophanous, glabrous, striate to the small, conic umbo, avellaneous-isabelline, margin concolorous, conspicuously striate, upturned and irregular with age; context very thin, dull-whitish, decidedly farinaceous in taste but without odor; lamellae deeply sinuate, almost free, very broad, ventricose, rather distant, pallid to rose-colored; spores subglobose to broadly ellipsoid, decidedly angular, apiculate, uniguttulate, rose-colored, 8–10 × 7 μ; stipe equal or slightly enlarged at the base, smooth, glabrous, concolorous, solid, 4 cm. long, 5 mm. thick.

This species was found abundant among weeds in the New York Botanical Garden in 1915, but has not been reported since. Its shape and color suggest *Inocybe,* of the rusty-spored series, but the spores are rose-colored.

Eccilia Housei Murrill

HOUSE'S ECCILIA

Plate 7. Figure 6. × 1

Pileus submembranous, campanulate, becoming deeply depressed at the center, cespitose, about 2 cm. broad; surface blackish with a fumosous tint, radiately furrowed and streaked with paler tints, minutely tawny-fibrillose and roughened but scarcely squamulose, margin somewhat irregular; context very thin, pallid; lamellae narrow, decurrent, rather distant, pallid or slightly yellowish when young, soon becoming salmon-colored; spores ellipsoid, angular, obliquely apiculate, rose-colored, 9–11 × 6–7 μ; stipe slender, hollow, grass-green, slightly fibrillose, 2–4 cm. long, 2–3 mm. thick.

Dr. H. D. House, state botanist, collected this species in clay soil in thickets at Green Lake, Onondaga County, New York, June 6, 1914, and referred it to *Leptonia euchlora* Quél. Its grass-green stipe is very characteristic.

Leptoniella subserrulata (Peck) Murrill

SUBSERRULATE-GILLED LEPTONIELLA

Plate 7. Figure 7. × 1

Pileus thin, convex or campanulate, umbilicate, 1.5–3 cm. broad; surface grayish-white, darker colored and squamulose on the umbilicus, margin obscurely striate; lamellae thin, crowded, adnate, at first white, bluish-black and minutely denticulate on the edges; spores irregular or angular, 10–11 × 7.5 μ, usually containing a single large nucleus; stipe slender, rather long, hollow, glabrous, whitish or pallid, 5–7.5 cm. long, about 2 mm. thick.

Described from New York, growing on low ground in woods, and also collected by Miss White in Maine. The gills are white at first, with bluish-black, finely denticulate edges.

Entoloma subjubatum Murrill

SCALY ENTOLOMA

Plate 7. Figure 8. × 1

Pileus convex to expanded, usually somewhat umbonate, becoming quite irregular with age, gregarious, 5–7 cm. broad; surface dry, imbricate-squamulose, especially at the center, fuliginous when young, usually fading to avellaneous with age, the disk remaining darker, margin pallid, usually lobed or cracked in older specimens; context thin, white, without odor, but with a pleasant, nutty-farinaceous taste; lamellae deeply sinuate, broad, ventricose, not crowded, salmon-colored, dark-isabelline in dried specimens; spores ellipsoid, angular, 8–9 × 6–7 μ; stipe cylindric, equal, slightly twisted at times, whitish or avellaneous, pruinose or fibrillose, solid, 6–8 cm. long, 1 cm. thick.

Described from handsome specimens collected by Miss Eaton on the ground in woods in the New York Botanical Garden. It is a rare species, being known only from Massachusetts and southern New York, and resembles *Entoloma jubatum* of Europe.

Eccilia pungens Murrill

PUNGENT ECCILIA

Plate 7. Figure 9. × 1

Pileus convex, not fully expanding, deeply umbilicate, gregarious, 4–6 cm. broad; surface smooth, glabrous, hygrophanous, avellaneous, somewhat striate with darker lines, margin incurved, concolorous, at first entire, becoming conspicuously lobed or plicate with age; context thin, pallid, with a sweetish, pungent taste and a distinct odor of chloride of lime; lamellae short-decurrent, subdistant, arcuate or plane, many times inserted, white to salmon-colored, entire and concolorous on the edges; spores broadly ellipsoid, angular, apiculate, uniguttulate, rose-colored, 8–10 × 7 μ; stipe equal, compressed, solid, smooth, glabrous, subconcolorous, 4–5 cm. long, 4–5 mm. thick.

Known only from specimens collected in woods in the New York Botanical Garden in August, 1915. When fresh, the hymenophores have a sweetish, pungent taste and a distinct odor of chloride of lime.

Entoloma albidum Murrill

WHITISH ENTOLOMA

Plate 7. Figure 10. × 1

Pileus convex to plane or slightly depressed, not umbonate, gregarious, 5 cm. broad; surface smooth, shining, glabrous, white, becoming tinged with avellaneous with age, margin entire or slightly lobed, concolorous; lamellae sinuate, rather narrow, crowded, salmon-colored, entire on the edges; spores globose, angular, apiculate, rose-colored, 7–8 μ; stipe equal or slightly tapering upward, smooth, white, glabrous, stuffed, about 8 cm. long and 1 cm. thick.

This species is white or whitish throughout until the gills are colored by the maturing spores. It was found at Stockbridge, Massachusetts, in September, 1911, in the edge of the woods near the summer home of Dr. W. Gilman Thompson, who was collecting with me at the time.

NEW YORK BOTANICAL GARDEN.

STUDIES OF THE SCHWEINITZ COLLECTIONS OF FUNGI—I

SKETCH OF HIS MYCOLOGICAL WORK

C. L. Shear and Neil E. Stevens

(With Plates 8 and 9)

Introduction

In view of the great importance of Schweinitz's mycological work, it seems desirable to publish certain information which the writers have accumulated and which has a direct bearing on the identification and interpretation of his species, types, and specimens.

Schweinitz's experience and training in Europe in connection with the preparation of the Fungi of Niesky (2) was of great value to him in his later studies of American fungi. His correspondence and exchange of specimens with Fries and Kunze were also of great assistance to him in the identification of American species. The general lack of knowledge of the microscopic characters of fungi at that period and the limitations of time and facilities naturally led to many errors in identification and imperfections in description. Notwithstanding this, Schweinitz must be regarded as the first great American mycologist. Some idea of the extent of his mycological work may be gained from the following summary:

His three published works on American fungi (11, 12, 13) contain a total of 4,491 species. Of these 1,533 were described as new and 10 new genera were established. He states in the index to his herbarium under date of July, 1828, that he had 2,800 specimens of fungi and many more were added later.

The most complete biographical sketch of Schweinitz is that by Walter R. Johnson (6), which was read before the Academy of Natural Sciences of Philadelphia, May 12, 1835, and published the same year. This paper is an appreciation rather than a

biography but contains many of the facts of Schweinitz's life and as it was compiled shortly after his death by a personal friend is the most direct source of information concerning his life and botanical work. Briefer sketches have been published by Morgan (10), Kellerman (7), Shear (14), Harshberger (5), and Lloyd (9). These are largely compiled from the memoir by Johnson and contain no new material.

Unsigned biographical sketches have been published in the Journal of the Elisha Mitchell Scientific Society for 1886 and in Popular Science Monthly for April, 1894. The former (4) appears to have been prepared by Professor J. W. Gore, at that time resident vice-president of the Society. In addition to data given by Johnson this paper contains some material obtained from Schweinitz's second son, Bishop Edmund de Schweinitz, of Bethlehem, Pa. The latter (16) is one of a series of biographies which appeared in Popular Science Monthly, most of which were anonymous and were prepared, presumably, by Dr. William J. Youmans, then editor of the Journal. This paper contains information as to Schweinitz's sons, obtained probably from his second son, Robert.

October 27, 1904, Miss E. A. Lehman presented a paper on Schweinitz (8) before the Wachovia Historical Society, of Salem, N. C. Miss Lehman has informed the writers that the material for this paper was largely furnished by Miss Adelaide Fries, a great granddaughter of Schweinitz who has made a special study of the history of the Moravians in the vicinity of Winston-Salem, N. C.

Recently, in connection with studies of the genus *Endothia,* the writers have had occasion to publish considerable information concerning Schweinitz's methods of work, together with illustrations of some of his manuscripts and specimens.

In addition to these publications the writers have had access to the Schweinitz manuscripts preserved in the library of the Philadelphia Academy of Sciences; his correspondence partly in the possession of his grandson, Dr. George de Schweinitz, of Philadelphia, and partly in the Philadelphia Academy; and many of his letters to Torrey now preserved at the New York Botanical Garden. In assembling information regarding the history

of Schweinitz's collections of fungi, the writers have been assisted by Miss Elsie M. Wakefield, of the Royal Botanic Gardens, Kew, England, Miss Alice Swayne, of Kennet Square, Pa., Mr. Wm. J. Stevenson, Jr., Dr. George de Schweinitz, and Dr. Edward J. Nolan, of Philadelphia, Dr. N. L. Britton, of New York, Mr. Eugene A. Rau, of Bethlehem, Pa., and Dr. W. G. Farlow, of Cambridge, to all of whom they wish to express their great indebtedness and appreciation.

Work on Fungi

Although born in this country (Bethlehem, Pa., Feb. 13, 1780), Lewis David von Schweinitz entered the Theological Institution at Niesky (Prussia), in 1798 and it was there that his first mycological work was done.[1] In collaboration with his teacher, Professor J. B. de Albertini, he published in 1805 the Conspectus Fungorum in Lusatiae. This book contains twelve colored plates, the work of Schweinitz.

He apparently remained at Niesky as student and teacher until 1807 when he was called to Gnadenburg, and subsequently to Gnadau as a preacher in the Moravian Church. From the latter post he came to America in 1812, having been appointed administrator of church estates in North Carolina (8). Before leaving Europe he was married by his friend Albertini, to Louisa Amelia Le Doux, a descendant of a French Huguenot family then residing in Pomerania. Napoleon's military activity made it necessary for them to come by way of Denmark and Sweden, a circumstance which resulted in Schweinitz's becoming acquainted with members of the University at Kiel in Holstein, from which institution he received in the same year the honorary degree of Doctor of Philosophy.

Arriving in this country after a voyage made eventful by the opening of the war between England and the United States Schweinitz and his bride stayed a short time in Bethlehem, Pa. It is probable that his collections in this vicinity were begun at this time, as the fifth species mentioned in his Fungi Carolinae Superioris, which was completed before he took up residence in

[1] Johnson (6) mentions the fact that while a young student at Nazareth, Pa. (1787–1798), he showed great interest in botany and prepared a partial flora of the region.

Bethlehem bears the following comment, "Est tantum in Pensilvania, Bethlehem." According to Miss Lehman he reached Salem, North Carolina, November 14, 1812. Here from the first he devoted much time to the study of fungi.

In his own words,[2]

> "When I first came to Carolina I almost exclusively attached myself to the fungi and formed a considerable collection, now amounting to about 1,500 species, entirely from my neighborhood, which still keeps increasing. Of the preservable ones (Fungi) I have with few exceptions preserved specimens in my collection. The Agarici, etc., except the Pleuropodes, I excluded entirely, because, although they may be dried, they lose all their characteristics, and I try to make drawings of such as appear new, and at the beginning of the year I have commenced an augmentation in such a manner that I have 5 parallel collections as complete as I can obtain specimens in order to send to friends who wish to have them."

Schweinitz went to Europe again in 1817 (8) to attend a meeting of his denomination at Herrnhut. He took to Europe on this journey[2]

> "My catalog of fungi, together with descriptions of all the new species by me established and specimens of them I took with me to Europe on my visit there in the year 1817–18, and left them in the care of Dr. Schwägerichen at Leipsic to make use of them at his discretion."

Schweinitz apparently returned to Salem in 1819. Miss Lehman speaks of this European visit as lasting three years, but various letters now preserved in his correspondence indicate that he was in Salem in 1819 and the volume of manuscript notes in the Philadelphia Academy of Science bears the superscription

Observations in Cryptogamiam
Salem Carolina
de med. November 1819

19 Nov.

It is evident from this that on his return to Salem Schweinitz again took up the study of the flora, especially the fungi. Shortly after his return Schweinitz welcomed a co-worker, also an officer of the Moravian Church.

> "By the Rev. C. F. Denke, lately established in our vicinity, the Botanical Fraternity of North Carolina has obtained a valuable recruit and now forms a Quadro, Rev. Jacob van Vleck, C. F. Denke and myself here, and Professor Mitchell at Chapel Hill."[2]

[2] Letter to Torrey dated Salem, Stokes Co., N. C., Jan. 24, 1820.

Although carried on as an avocation in the midst of pressing church duties, his mycological work bears every evidence of care and accuracy. In the studies on which were based the manuscript taken to Europe in 1817 he certainly made use of a compound microscope of considerable power. That this microscope is the same one to which he refers in 1820 as the "great microscope"[3] and which is now in the possession of his grandson, Dr. Geo. de Schweinitz of Philadelphia (see *Plates 8 and 9*), is very probable, since this instrument was manufactured by Adams of London, and is of a type very closely resembling the "Jones Improved Compound Microscope" (1) manufactured about 1798. This microscope has a set of seven simple objectives numbered 1 to 7, as well as four lenses with polished metallic rims "specula" and is in every respect one of the best instruments made at that time.

Examination and use of Schweinitz's microscope fully confirms Arthur's (3) belief that the reasons for the errors in Schweinitz's descriptions of microscopic characters are to be sought in the imperfections of his instrument. The chief causes of the mistakes were, however, not so much the manner of mounting the spores or the low magnification, as suggested by Arthur, but the lack of spherical and chromatic correction of the lenses and the poor illumination, resulting in very poor definition. An excellent illustration of the imperfections of this instrument can be obtained by examining spores of Schweinitz's *Clasterisporium caricinum* with a modern microscope and comparing the appearance with his drawings (13, *Plate XIX, Fig. 4c*), which are faithful representations of the spores as they appear under his microscope, using objectives 1 and 2.

This inevitable difference in the instruments used by mycologists of successive generations, adds emphasis to the importance of securing and preserving authentic type specimens, and to the value of such type specimens as compared with even the most careful published descriptions. It emphasizes also, as suggested by Arthur, the importance of noting very carefully the kind of microscope used and especially the desirability of preserving microscopes of every period in museums and laboratories.

[3] Letter to Torrey dated June 24, 1820.

Schweinitz continued his study of the flora of North Carolina until his removal to Bethlehem, Pa., late in 1821, probably about November 20.[4] At Bethlehem, Schweinitz came into closer touch with several American students of botany, a circumstance which he evidently greatly appreciated. In the introduction to the Synopsis Fungorum in American Boreali (13 p. 141) he says "Sub finem autem anni jam dicti [1821], in paterna mea domicilia Bethlehem, Northampton County, Pennsylvaniae denum redux. . . . Botanophili Americani plurimi jam mihi propinquiores, quam degenti olim apud occidentales Carolinenses, penitus toto ab orbe divisos, summa benevolentia et summo studio, quos ipsi invenerant aut quos illis aliunde missi sunt communicaverunt, prae ceteris amicissimus doctissimusque D. John Torrey, Noveboracensis Universitatis Professor."

Torrey was throughout this period Schweinitz's most frequent and valued American botanical correspondent. Torrey at times sent him fungi for identification (15, p. 8), and also loaned him books[5] which happened to be inaccessible, among others Fries's Systema Mycologicum, Pt. 1. At one time Torrey and Schweinitz evidently had under consideration the publication of a joint Cryptogamic Flora.[6]

Schweinitz resided at Bethlehem from 1821 until his death, February 8, 1834, and here he completed, in addition to several papers on higher plants, his most important scientific work, the Synopsis Fungorum in America Boreali (13). During this period Schweinitz twice made journeys on church affairs. In the summer of 1831 he went to Hope, Indiana, to organize a church there. Somewhat earlier he went to Europe to attend a meeting of his denomination at Herrnhut. The date of this journey is given by Johnson and Miss Lehman as 1824, but letters to Schweinitz from Hooker and Torrey indicate that it was made in 1825.[7]

During the latter years of his life Schweinitz regularly used the prefix, de, in his signature, though he never seems to have

4 Letter to Torrey dated October 29, 1821.

5 Letter to Torrey dated Bethlehem, May 15, 1822.

6 Letter to Torrey dated January 16, 1825.

7 Under date of March 30, 1825, Torrey mentions an effort to meet Schweinitz in New York on the latter's way to Europe.

abandoned the abbreviation, L v S in his manuscripts. This change may have been due to his habitually writing his scientific papers in Latin or, as suggested by Dr. George de Schweinitz in a recent conversation, it may very probably have been done out of consideration for his wife, who, as mentioned above, was of French ancestry. His sons all retained the later form.

MYCOLOGICAL PUBLICATIONS

Following the joint paper with Albertini mentioned above, Schweinitz's next mycological publication was the Synopsis fungorum Carolinae superioris (10). The circumstances of its publication are given in a letter to Torrey.[8]

> "I would have deferred writing longer had not the present good opportunity afforded for transmitting to you a copy of a small work bearing my name on its title page, which was sent to me from Germany—to my no small surprize, as I was utterly unaware that it would be published—although I must confess myself the author. I left it with a friend some years ago, without any such idea, but have no objection that he disposed of it that way. Possibly it will be not uninteresting to you, as it contains a list of all the fungi I had observed in N. C. previous to 1817, with definitions of the new ones, and I therefore beg of you to accept it as a token of my friendship."

The date of publication of this paper is given by Johnson as 1818 with the remark: "The date of this paper is only mentioned on personal information." The source of this "personal information" is unknown and there is no definite indication as to its authenticity. The volume, of which this paper forms a part, was published in 1822 and bears that date. Schweinitz's paper is, however, in the early part of this volume (pp. 20–132) and there is a copy of a separate in the Library of the Philadelphia Academy paged 1–105 but bearing no date. This separate was received for the Academy by Z. Collins in December, 1822.[9] That Schweinitz himself did not receive copies of this paper until late in 1822 is shown by the letter just quoted and as he was in Europe during 1818 it is improbable that the paper could have been issued then without his knowledge.

In 1825 Schweinitz published a short paper entitled Description of a number of new American species of Sphaeriae (12).

[8] Letter dated Bethlehem, November 24, 1822.

[9] Letter from Collins to Schweinitz.

As is indicated by the introduction this is supplementary to the paper on the fungi of North Carolina.

Schweinitz's last and most important published work was the Synopsis Fungorum in America Boreali (13). This was published by the American Philosophical Society, Philadelphia, in the volume of Proceedings dated 1834. It was, however, actually issued as a separate two years earlier, as shown by the following note now in the possession of Dr. George de Schweinitz, of Philadelphia.

PHILAD. 29 July 1832.

M. L. D. SCHWEINITZ
Bethlehem

Sir:

By your friend the Pr. of Newid who visits us under the name of Baron de Bramsberg I have the pleasure of sending you six copies of your work making part of one [our] 4th vol. N. S. Copies will go shortly to the Different Academies and Philos Societies of Europe—to the number of about 40—We anticipate the respect with which this valuable work will be received. We have more copies at your service please inform me of the disposition of these.

I remain yours sincerely
JN VAUGHAN
Lib. of Am. Ph. Soc.

In a letter dated October 22, 1832, Torrey acknowledges the receipt of two copies, one intended for Halsey, and takes the opportunity to congratulate his friend on the "completion of this great performance." He adds this pertinent remark, "If we now had the other departments of our Acotyledones finished, we would have our entire Flora *posted up* to the present day. When shall we have our Lichens, our Musci, our Algae & our Hepaticae? Life is too short—too valuable, I ought to have said, for any *one* of us to undertake the whole."

MANUSCRIPTS

Johnson (6 p. 36–38) mentions, in addition to Schweinitz's published works, "other productions of his pen . . . some of which still remain in manuscript." Of these manuscripts a number are known to have been preserved. Mr. Eugene A. Rau informs the writers that he has several manuscripts given to him by one of Schweinitz's granddaughters, among these is Schwei-

nitz's Flora of Salem, North Carolina, which also contains marginal notes of plants that he collected in the vicinity of Bethlehem. The date of this manuscript is 1821—it is a book 8 by 13 inches with 165 pages, of which 120 pages are devoted to Phanerogams, 4 pages to Filices, 11 pages to Musci and Hepaticae, 3 pages to Fresh Water Algae, 22 pages to Lichens.[10] This is evidently the unpublished portion of a flora of the vicinity of Salem, N. C., of which The Synopsis fungorum Carolinae Superioris formed a part.

Mr. Rau also has "an index to his herbarium 1822," a book which "contains a list of his correspondents with their addresses," an "Index Herbar, Europ." and a "list of Amer. Fungi in his collection."[10]

In the Library of the Academy of Natural Sciences, Philadelphia, are the following manuscripts dealing mostly with Fungi:

> Schweinitz's Index to his herbarium marked: "Index Herbarii Ludovici Davidis de Schweinitze 1824. Adjectis plantis omnibus Zonae temperatae Graminaceis autem ac Cryptogamis totius orbis."

This is a large folio volume of several hundred pages, not numbered, containing a MS. list in Schweinitz's handwriting of the species contained in his herbarium. There is a final summary on the last page dated July, 1828, giving a list of the various orders of plants and the number of each. The grand total is 16,266 specimens, 2,800 of which are fungi."

Also a manuscript on octavo sheets with the following title:

> "Description of some new American Species of the Genus *Sphaeria* being the first Genus of the Second Order *Pyrenomycetes* of the Second Class of Fungi *Gasteromycetes* according to the system of Mycology of Dr. Elias Fries supplementary to the Synopsis of Carolinian Fungi by L. De Schweinitz published in the Comentaries of the Society of Naturalists of Leipzig by Dr. Schwägerichen."

There are also three folio volumes of unpublished plates entitled "Fungorum Nieskiensis Incones" in the library. Mr. Rau states that at one time six or seven volumes of colored plates were loaned him by Schweinitz's son, Bishop Edmund de Schweinitz. Where these are is now unknown. There is now in the possession of Mrs. Lemly, a granddaughter of Schweinitz, of

[10] Extracts from letter written by Mr. Rau, February 8, 1917.

Salem, N. C., a volume of unpublished plates marked Part 1 of the Fungorum Nieskiensis. In the Library of the Philadelphia Academy there are also numerous loose quarto colored plates of American fungi.

At the close of the life of Schweinitz published in the Journal of the Elisha Mitchell Society in this note: (4, p. 25)

> "There is also in the possession of his son, Bishop de Schweinitz, of Bethlehem, Pa., a manuscript work entitled: 'Synopsis Fungorum Americanorum qui Ludovicus David de Schweinitz innotuere. Secundum Systema Fries.' This work is different from No. 10 [Synopsis Fungorum in America Boreali media degentium] but whether written before or after is unknown. The manuscript is carefully written in three bound volumes, 8vo: the first having 116 pp., the second 175 pp., the third 100 pp. Some of the pages except the running title on the top are blank and were evidently to be filled out as the researches proceeded."

This manuscript the writers have been unable to locate.

SOURCES OF SCHWEINITZ'S HERBARIUM

On the inside of the title page of the manuscript index to his herbarium in the library of the Philadelphia Academy, Schweinitz lists seventy individuals and herbaria as "contributores." Of these the following are mentioned either in the Synopsis fungorum in America Boreali (13) or in the Synopsis fungorum Carolinae Superioris (11), as having contributed specimens of fungi; Dr. Baldwin, Zaccheaus Collins, John Le Conte, C. F. Denke, Abram Halsey, Dr. Krampman, Dr. John Torrey, and Jacob Van Vleck. European specimens of fungi were sent by Fries, Burkhardt, Kunze, and Schwaegrichen.

Undoubtedly, the greater portion of the herbarium was collected by Schweinitz himself and a very large number of the specimens come from the regions about Salem, N. C., and Bethlehem, Pa., at which places most of his life in this country was spent. Miss Lehman remarks that he collected specimens "of every plant within a radius of 30 miles from Salem," and the localities cited by him indicate that his collecting trips about Bethlehem covered an even greater area. Letters to Torrey speak of collecting trips to "The Grandfather Mountains, [N. C.] . . . chiefly for Cryptogams" and of wishing to get in connection

with Nuttall to get western Cryptogams;[11] also of "making a journey to Muskingum [Ohio] in July;"[12] and of a trip to Lake Erie lasting for a month.[13]

Specimens of Fungi Distributed by Schweinitz

From the letter to Torrey quoted above (p.—) it is apparent that Schweinitz on his visit to Europe in 1817–1818, left with Schwaegrichen specimens of all new species of fungi which he had described up to that time. Thus far it has been impossible to locate this collection although the senior author has made a careful search in the principal herbaria of Europe. The only Schweinitzian specimens known to have come from Schwaegrichen's Herbarium are a few which were found in Kunze's collection in the Herbarium of the University of Leipsic and a single specimen, which had apparently been sent to Nees von Esenbeck, in the Herbarium at Strasburg.

From the same letter it is also evident that Schweinitz began at least as early as 1820 the systematic preparation of duplicates for distribution. His method of preparing these duplicates is evident from the original packets preserved in the Philadelphia Academy of Sciences. In some cases there are two or three small packets labeled the same as the larger packet except that they bear the numbers 1, 2, 3, etc. For example "Sphaeria Castanea L. v. S. Beth. & Sal" is on one packet, and on a smaller packet "Sph. Castanea L. v. S. 3." In Kunze's herbarium at Leipsic and in the Link herbarium at Berlin, at Kew, at Upsala, and elsewhere, are autograph specimens of Schweinitz which bear these small numbers.

Throughout Schweinitz's life an active exchange of specimens was carried on between himself and Torrey.[14] Later Torrey presented to Berkeley and Curtis the fungi given him by Schweinitz. Part of this collection is now in Berkeley's herbarium at Kew, and part in the Curtis herbarium at Harvard.

Schweinitz doubtless sent collections of fungi to some of his

[11] Letter dated Jan. 11, 1821.

[12] Letter dated May 25, 1823.

[13] Letter dated Dec. 5, 1827.

[14] Several letters from Schweinitz to Torrey.

correspondents at several different periods. Definite records of these exchanges exist in a few cases. Some time previous to 1824 Schweinitz sent to Abram Halsey, an amateur botanist of New York, a collection of fungi.[15] This collection the writers have endeavored to trace but there seems to be no record of its existence. Descendants of Halsey believe it to have been destroyed by a fire in a Brooklyn Museum.

In 1824 packages of fungi were sent to Hooker[16] and to Fries.[17] Those sent to Hooker are preserved in the herbarium at Kew and Fries's specimens are in the herbarium at Upsala.

Schweinitz's first gift of specimens of fungi to an herbarium in this country seems to have been made in 1827 to the Academy of Natural Sciences, Philadelphia. The exact date and manner of this gift is made clear by the recent discovery in the letter files of the Academy of the following note from Z. Collins.[18]

"The class Pyrenomyceti of Dr. Fries in fourteen genera of North American Fungi to-wit:

Sphaeria	Phacidium
Lophium	Hysterium
Sphaeronema	Glonium
Cytisporea	Actidium
Phoma	Actinothyrium
Dothidia	Sacidium
Rhytisma	Leptostroma

In upwards of 500 species. Deficient in 150 species. From the collection of Mr. L. D. Schweinitz and by him presented to the A. N. S. through his friend Z. Collins. March 20, 1827."

Comparing the lists in Schweinitz's handwriting on the packets in the collection with the above note it is evident that they agree except that Collins omitted one genus, namely Prostemium, when he listed them. A memorandum by Schweinitz on the last folder, Number 10, says: "Summa Pyrenomycetorum 527—Desunt 153."

This collection is in ten small folio heavy paper wrappers with

15 In an undated letter to Schweinitz Halsey thanks him for the "Highly prized collection [of fungi] you have some time since sent me." Elsewhere in the letter he says, "I have just received from Hamburg, the 1st vol. of the Bryologia Germanica by Nees & Hornschurch, . . . just printed." The date of this publication was 1823.

16 Letter from Hooker dated July 2, 1825.

17 Letter from Fries dated April 15, 1824.

18 This note is in the file dated 1826–1840 under the letter "S."

lists of the inclosed genera and species on the outside. The species are in small paper packets bearing Schweinitz's autograph labels. These packets rarely bear the small numbers used on his regular duplicates and were evidently taken in case no number occurs from the original packet of the species. To distinguish this collection from the Schweinitz Herbarium later bequeathed to the Academy, the writers will refer to this as the "Collins collection."

Brongniart[19] in a letter dated April 24, 1829, and Greville[19] in a letter dated 1830, acknowledge the receipt of collections of plants from Schweinitz. Brongniart speaks specifically of Cryptogams. These were in part at least fungi, as autograph specimens of fungi from Schweinitz are found in the Brongniart herbarium at Paris and in Greville's herbarium at Edinburgh. In a letter dated 1830 Dr. Zeyher, director of the Botanic Garden at Schwetzingen, acknowledges the receipt of specimens of fungi.

In addition to the specimens listed above the senior writer has examined autograph specimens of fungi in the following herbaria: that of Kunze at Leipsic, of Jacquin at Vienna, of Link and of Ehrenberg at Berlin, and of Nees von Essenbeck at Strasburg.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

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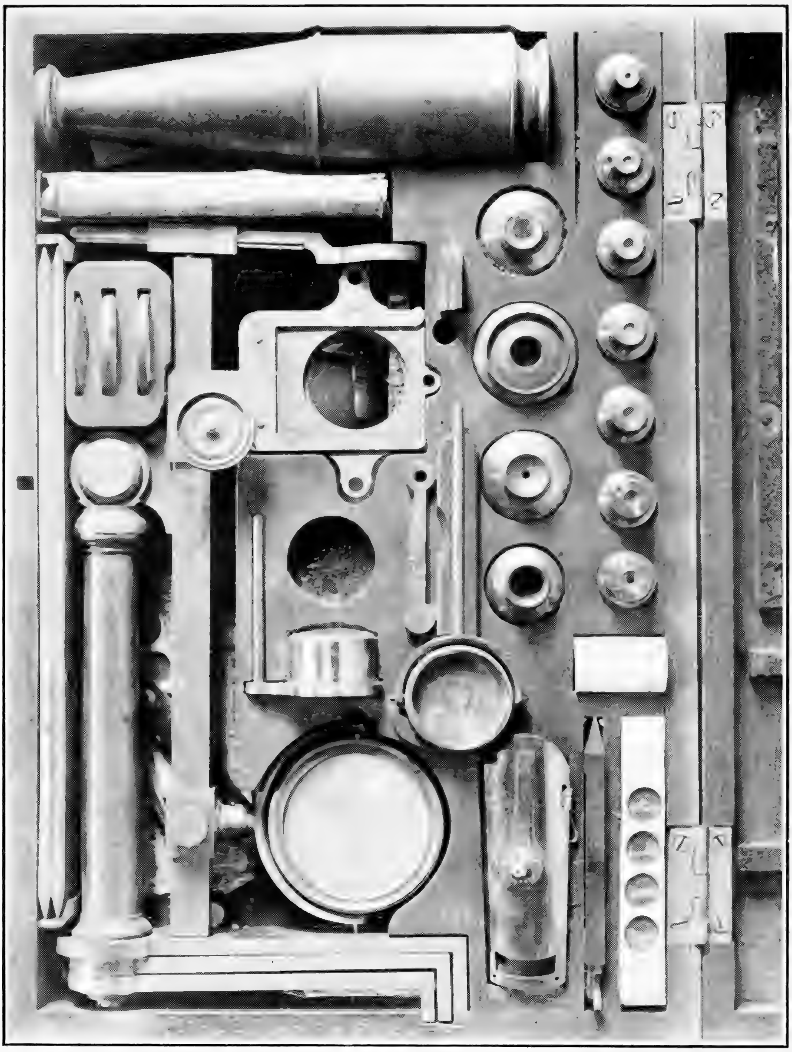
MICROSCOPE OWNED AND USED BY SCHWEINITZ IN HIS STUDIES OF FUNGI



SCHWEINITZ' MICROSCOPE WITH ACCESSORIES IN ITS CASE

NORTH AMERICAN SPECIES OF PUCCINIA ON CAREX[1]

Frank D. Kern

In spite of an accumulation of considerable information concerning the North American sedge rusts most mycologists have regarded this group as especially difficult. This is perhaps due to the fact that the telia and teliospores do not usually present diagnostic characters. In the characterization of these species it has been necessary to look for other features, and as has been the case in several other groups of the rusts, it has been found that the urediniospores have furnished reliable characters in many instances. The aecial connections as brought to light by cultures are also important. The presence of amphispores in some of these species, the correlation of some species with forms usually regarded as belonging to another genus, and the splitting of other species into races lend general biological interest to these studies.

In order that the results may be made as available as possible to those wishing to collect, or determine specimens of the group, considerable attention has been given to the preparation of keys and indices. The key relating to the aecial forms is somewhat unique and yet it is believed that even a cursory glance will reveal the way in which it may be useful. It is the idea that anyone having an aecial stage on a known genus of host should be able to make out whether or not it belongs to a Carex rust, and if so, to locate the species without difficulty. No host bears the aecia of more than one species. Altogether thirty genera serve as aecial hosts distributed among ten families, only one of which is monocotyledonous. Eight orders are represented. The following table shows the distribution of the aecial hosts.

[1] Read before the Botanical Society of America at the New York meeting, December 30, 1916. Contribution from the Department of Botany, The Pennsylvania State College, No. 10.

TABULAR VIEW OF THE AECIAL HOST FAMILIES

Class	Order	Family	Fam. No.*	Genera †
Monocotyledoneae	Liliales	Smilaceae	25	1
Dicotyledoneae	Urticales	Urticaceae	43	2
	Rosales	Grossulariaceae	84	1
	Myrtales	Lythraceae	128	1
		Onagraceae	130	4
	Primulales	Primulaceae	142	2
	Polemoniales	Phrymaceae	169	1
	Rubiales	Caprifoliaceae	172	1
	Campanulales	Cichoriaceae	179	7
		Carduaceae	181	10

* The number given here is the serial number of the families of the angiosperms according to Britton & Brown, Illustrated Flora, 2d edition.

† The numbers in this column indicate the number of genera in a family known to bear aecia.

Under the accounts of the species it has been the aim to include various notes which might not find a place in a purely systematic presentation. No attempt has been made to describe the aecial stages and for the sake of brevity the descriptions of the uredinial and telial stages have been confined chiefly to the spores, the sori being mentioned in only a few instances because they do not furnish diagnostic characters as a rule. Nineteen species are now recognized, of which twelve have their life-histories worked out, three possess amphispores, and three are described as new. Six of the species are common to Europe and North America, one to Asia and North America, and one is known to occur also in South America. A total of 139 species of *Carex* are listed in this paper as hosts for the species of *Puccinia*. In 1913, 106 *Carex* species were known to serve as hosts which were then represented by 1200 North American collections in the Arthur Herbarium.[2] It is not known how many collections have been added during the last three years but the herbarium has been increasing rapidly.

No effort has been spared to make the host determinations as authentic as possible and in this connection thanks are due to Dr. Theo. Holm, of Washington, D. C., and to Mr. K. K. Mackenzie, of New York, for their painstaking examination of specimens

[2] Other interesting statistics regarding the North American Carex rusts are given by Professor Arthur in Mycologia **5**: 240–244 (1913).

submitted to them. This work of host determination has been tedious; the opening of the mycological packets and the fragmentary condition of many of the specimens must frequently have been irksone to phanerogamic botanists but these gentlemen have most cheerfully responded to numerous requests for identification.[3]

In making up the lists of hosts under the different species only the names considered to be most acceptable are included, omitting all which are regarded as synonyms. In order to make these synonyms, some of which may be commonly known, also available they are included in the Index to Rusts Occurring on Various Species of Carex at the end of this paper, with proper cross references.

The studies have been carried on over a considerable interval, ten years or more, during which time the routine duties of teaching and experiment station work have claimed the larger share of effort, and yet there has been a continuous interest and numerous periods of varied extent have been devoted wholly to this group. The work which has been done directly with the idea of preparing a monographic account has been made possible only by the initial and continued support of Professor J. C. Arthur and his staff of botanical assistants, among whom Miss Mary A. Fitch deserves especial mention. The painstaking observations and careful records made by Miss Fitch at a time when the whole matter was in a very chaotic condition assisted very materially in establishing a working basis. Five years ago a paper entitled A Revision of the North American species of Puccinia on Carex was presented in brief form by the writer before the Botanical Society of America.[4] Miss Fitch was included as a joint author but the paper was published only in abstract form.[5] Since that presentation the studies have been continued, but without the aid of Miss Fitch, and the results of the more recent work are incorporated in this paper. The value of the foundational work of Professor Arthur and of his continued assistance cannot be overestimated.

[3] For notes concerning the activities of Dr. Holm see Torreya 13: 72 (1913) and Mycologia 5: 240–244 (1913).

[4] Washington meeting, December 27, 1911.

[5] Science, N. S. 35: 150. 1912.

For collections of specimens and suggestions as to relationships thanks are due to generous friends in various parts of the country and are hereby most heartily accorded.

A. **Uredinia and telia exclusively considered**

Host belonging to genus *Carex* (family Cyperaceae).
  Urediniospores with pores in an equatorial zone.
    Pores 2 (in occasional spores 3).
      Urediniospores medium-sized (16–21 × 20–26 μ), wall 1–2 μ thick.
        Urediniospores of the modified sort (amphispores) unknown .... 1. *P. Kellermanii.*
        Urediniospores of the modified sort (amphispores) with chestnut-brown wall, thicker above .... 2. *P. atro-fusca.*
      Urediniospores very large (26–37 × 35–61 μ), wall 2.5–3.5 μ thick .... 3. *P. macrospora.*
    Pores 3 (in occasional spores 4).
      Urediniospore-wall moderately thick (2 μ and more) .... 4. *P. spatiosa.*
      Urediniospore-wall moderately thin (2 μ and less).
        Urediniospores rather large (18–26 × 24–39 μ).
          Teliospores small (26–42 μ long). 5. *P. minuta.*
          Teliospores large (39–71 μ)....... 6. *P. urticata.*
        Urediniospores medium-sized (15–21 × 19–32 μ).
          Teliospores moderately small (32–45 μ long); urediniospore-wall cinnamon-brown .... 7. *P. Lysimachiae.*
          Teliospores medium-sized (32–58 μ long), urediniospore-wall golden-brown .... 8. *P. Grossulariae.*
          Teliospores large (45–67 μ long), urediniospore-wall cinnamon-brown .... 9. *P. eminens.*
    Pores 4, urediniospores pale yellow; urediniospores of the modified sort (amphispores), chestnut-brown with 2 equatorial pores...... 10. *P. microsora.*
  Urediniospores with pores in an extra-equatorial zone.
    Pores 2, above the equator.
      Pores slightly above the equator, i. e., superequatorial.
        Urediniospores small (12–18 × 16–21 μ) wall golden-brown. .... 11. *P. minutissima.*
        Urediniospores medium-sized (15–

20 × 20–26 μ) wall cinnamon-brown ....12. *P. universalis.*
Pores considerably above the equator, i. e., in the upper part of spore.
Urediniospores small (12–19 × 16–23 μ).
Teliospores small (29–45 μ long)..13. *P. Phrymae.*
Teliospores medium-sized (25–50 μ or more, long)............14. *P. asterum.*
Urediniospores medium-sized (15–20 × 19–26 μ).
Telia roundish or oval, comparatively broad ....15. *P. Peckii.*
Telia mostly oblong or linear, comparatively narrow ....16. *P. patruelis.*
Urediniospores rather large (17–23 × 24–32 μ), chiefly lenticular ....17. *P. Sambuci.*
Pores 1 or 2, below the equator.
Pores 2, slightly below the equator, i. e., subequatorial ....18. *P. Caricis-strictae.*
Pore 1, considerably below the equator, near the hilum .... 8. *P. Grossulariae.*
Urediniospores with scattered pores ....19. *P. karelica.*

B. **Aecia exclusively considered**

Aecia scattered, from diffused mycelium .... Excluded.
Aecia grouped, from limited mycelium.
Aecia rupturing by an ostiolar pore .... Excluded.
Aecia cupulate.
Host belonging to family Smilaceae (genus *Smilax*).
Aeciospores medium-sized (15–26 μ), the wall uniform .... Excluded.
Aeciospores very large (32–51 μ), the wall much thicker above .... 3. *P. macrospora.*
Host belonging to family Urticaceae.
Host belonging to genus *Boehmeria*, aeciospores very small (10–13 μ) .... Excluded.
Host belonging to genus *Urtica*, aeciospores medium-sized (15–23 μ) .... 6. *P. urticata.*
Host belonging to family Grossulariae (genus *Ribes*) .... 8. *P. Grossulariae.*
Host belonging to family Lythraceae (genus *Decodon*) ....11. *P. minutissima.*
Host belonging to family Onagraceae.
Host belonging to genus *Ludwigia* or *Anogra* .... Excluded.
Host belonging to genus *Gaura, Onagra, Meriolix,* or *Pachylophus* ....15. *P. Peckii.*

Host belonging to family Primulaceae.
Host belonging to genus *Glaux* or *Steironema* .... Excluded.
Host belonging to genus *Lysimachia* ....7. *P. Lysimachiae.*
Host belonging to genus *Trientalis* ....19. *P. karelica.*
Host belonging to family Phrymaceae (genus *Phryma*)....................................13. *P. Phrymae.*
Host belonging to family Caprifoliaceae (genus *Sambucus*) ....17. *P. Sambuci.*
Host belonging to family Cichoriaceae.
Host belonging to genus *Lampsana* .... Excluded.
Host belonging to genus *Adopogon, Agoseris, Crepis, Lactuca, Nothocalais, Hieracium* or *Prenanthes* ....16. *P. patruelis.*
Host belonging to family Carduaceae.
Host belonging to genus *Ageratum, Arnica, Bahia, Bigelovia, Boltonia* (uncertain), *Borrichia, Carduus, Chrysogonum, Chrysopsis, Chrysothamnus, Cirsium, Clibadium, Coleosanthus, Conoclinium, Desmanthodium, Dugaldia, Eriophyllum, Eupatorium, Gnaphalium, Gutierrezia, Gymnolomia, Helenium, Helianthus, Helianthella, Heliopsis, Laciniaria, Montanoa, Polymnia, Rudbeckia, Senecio, Silphium, Verbesina, Ximenesia,* or *Zexmenia* .... Excluded.
Host belonging to genus *Aster, Doellingeria, Eucephalus, Euthamia, Erigeron, Grindelia, Leptilon, Oreochrysum* or *Solidago* ....14. *P. asterum.*
Host belonging to genus *Artemisia* ....12. *P. universalis.*

1. **Puccinia Kellermanii** sp. nov.

O & I. Pycnia and aecia unknown.

II. Urediniospores ellipsoid, 18–21 × 25–28 μ; wall light golden-brown about 1.5 μ thick, moderately and distinctly echinulate, the pores 2, or sometimes 3, equatorial.

III. Telia scattered, chiefly on the upper part of the culm or on the rachis, oval or oblong, 0.4–0.8 mm. long, early naked, chocolate-brown; teliospores clavate-oblong, 16–21 × 39–45 μ, rounded or sometimes narrowed above, usually narrowed below, slightly constricted at the septum; wall varying from golden- to chestnut-brown, 1–1.5 μ thick, much thicker above, 9–10 μ; pedicel tinted next to the spore, once to once and a half length of spore.

On *Carex polystachya.*

Type collected near Antigua, Depart. Sacatepéquez, Guatemala, Feb. 3, 1908, *W. A. Kellerman, 7197;* other collections San Rafael, Jan. 10, 1915, *55*, and Solola, Jan. 27, 1915, *124*, both by *E. W. D. Holway.*

The Guatemalan collections here listed are used as the foundation of a new species. The pore arrangement throws this species in a group with *P. atro-fusca* and *P. macrospora* from which it differs markedly in other spore characters. There is a general resemblance to *P. urticata* but the pores in the Guatemalan specimens are usually 2, sometimes 3, whereas they are usually 3, rarely 4, in *P. urticata;* there are also differences in teliospores. The variations in spore characters plus the geographic interval between these specimens and any of the other species makes it seem wise to characterize a new species.

2. PUCCINIA ATRO-FUSCA (Dudley & Thomp.) Holway, Jour. Myc. **10**: 228. 1904

Uromyces atro-fuscus Dudley & Thomp. Jour. Myc. **10**: 55. 1904.

O & I. Pycnia and aecia unknown.

II. Urediniospores of the typical sort broadly ellipsoid, 16–21 × 21–26 μ; wall cinnamon-brown, 1.5–2 μ thick, rather closely echinulate, the pores 2, equatorial; urediniospores of the modified sort (amphispores) broadly ellipsoid or obovoid, 17–24 × 23–32 μ; wall chestnut-brown, 2.5–3.5 μ thick, somewhat thicker above, 4–7 μ, rather sparsely but prominently verrucose-echinulate especially above, the pores 2, approximately equatorial.

III. Teliospores narrowly obovate-ellipsoid or clavate-oblong, 16–22 × 30–43 μ, rounded or obtuse at each end, slightly constricted at the septum; wall chestnut-brown, 1.5–2 μ, much thicker above, 5–7 μ; pedicel slightly tinted, about length of spore.

On *Carex Douglasii, nigricans, praegracilis, siccata.*

DISTRIBUTION: Southern Alberta, Montana, and New Mexico west to the Pacific Coast.

EXSICCATI[6]: Barth. N. Am. Ured. *820, 1027;* Clements, Crypt. Colorad. Form. *547*; Barth. Fungi Columb. *2676, 3742.*

[6] In listing the Exsiccati those on the *Carex* host are given first and italicized; those on the aecial host are set apart by a dash and are not italicized.

The chief point of interest in connection with this species is the presence of two sorts of urediniospores. The urediniospores of the modified sort have been called amphispores. The chief modification is a greater thickness of wall presumably fitting them for living over winter. In some species amphispores are modified as to markings and pore arrangement. In this species the markings are more verrucose in their nature and more prominent but the pore arrangement is the same. The characters of the sori differ also, the amphisori being twice as large, more pulvinate and dark-chocolate-brown as compared with the cinnamon-brown uredinia. These amphispores have never been germinated but in other cases amphispores have been demonstrated to germinate and produce infection in the same manner as urediniospores.

3. PUCCINIA MACROSPORA (Peck) Arth. Mycologia **1**: 244. 1909
Aecidium macrosporum Peck, Ann. Rep. N. Y. State Mus. **23**: 61, 1873. Not *A. macrosporum* Diet. & Neg. 1896.

O & I. Pycnia and aecia on *Smilax* spp. (For cultures see Mycologia **1**: 243, 1909.)

II. Urediniospores obovate or narrowly ellipsoid, rather irregular, very large, 26–27 × 35–61 μ, often narrowed below to a thickened hilum; wall golden yellow, 2.5–3.5 μ thick, echinulate with prominent points 3–4 μ apart, the pores obscure, 2, or sometimes 3, equatorial.

III. Teliospores clavate, 16–23 × 61–67 μ, usually rounded or obtuse above, narrowed below, often slightly constricted at the septum; wall pale-cinnamon-brown, paler below, 1.5–2.5 μ, much thicker above, 9–16 μ; pedicel colorless, one half to once length of spore.

On *Carex comosa.*

DISTRIBUTION: Limited area near the coast from Long Island to Delaware, with a single collection of aecia from Kansas.

This is a remarkable but little known species. The very large size of the urediniospores even when compared with the form belonging to *Urtica,* which has always been regarded as having large urediniospores, attracts immediate attention. The aeciospores are also exceedingly large (32–42 × 37–51 μ) and it was in fact the similarity in these spore structures which was chiefly

responsible for the original culture. There are other cases where morphological correspondence between aeciospores and urediniospores has led to successful connections (see Arthur, Bot. Gaz. **29**: 274–275, 1900). Such cases tend to indicate a possible homology between these spore forms.

4. **Puccinia spatiosa** sp. nov.

O & I. Pycnia and aecia unknown.

II. Urediniospores broadly ellipsoid, $26–29 \times 30–39\,\mu$; wall light cinnamon-brown, $2–2.5\,\mu$ thick, sparsely and conspicuously echinulate, the pores 3, or sometimes 4, approximately equatorial.

III. Telia oval oblong or linear, 0.5–1 mm. long, blackish; teliospores narrowly obovoid, $24–29 \times 45–64\,\mu$, considerably constricted at the septum, rounded above, rounded or narrowed below; wall chestnut-brown, $1.5–2\,\mu$ thick, very much thicker above, $16–23\,\mu$; pedicel nearly colorless, once to once and a half length of spore.

On *Carex* sp.

Type collected at Brookings, S. D., March 21, 1908, *A. G. Johnson.*

So far as pore characters are concerned the form here described agrees with a group of species, of which the forms having aecia on *Urtica* and *Ribes* are prominent members, but it differs from all of these in having more robust especially broader spores, both uredinio- and teliospores. As compared with the usual oblong-clavate teliospores of the sedge rusts these are broad enough and rounded above so as to give an obovoid effect.

5. Puccinia minuta Dietel; Atkinson, Bull. Cornell Univ. **3**: 19, 1897

Puccinia riparia Holway, Jour. Myc. **10**: 163, in part. 1904.

O & I. Pycnia and aecia unknown.

II. Urediniospores broadly ellipsoid or obovoid, $19–26 \times 26–39\,\mu$; wall cinnamon-brown, about $1.5\,\mu$ thick, evenly and rather sparsely echinulate, the pores 3, approximately equatorial.

III. Teliospores clavate-oblong or cuneate, small, $13–23 \times 26–42\,\mu$, rounded or truncate above, not or only slightly constricted at the septum; wall light chestnut-brown, $1–1.5\,\mu$ thick, much thicker at apex, $5–10\,\mu$; pedicel slightly tinted, about one-half length of spore.

On *Carex lacustris, verrucosa.*

DISTRIBUTION: Known only from separated localities, Ontario, Wisconsin, Iowa, and Alabama.

The name *minuta* was applied by Dietel to a specimen collected at Auburn, Alabama, on *C. verrucosa,* the striking characters of which are the moderately large urediniospores and the very small teliospores. *Puccinia riparia* as described by Holway possessed these same characters and his specimens agree well with Dietel's material. Mr. Holway thought that the telial form which he decribed was associated with an aecidium on *Ribes floridum* but repeated attempts to infect *Ribes* with these spores from *C. riparia* have failed (Bot. Gaz. **35**: 22, 1903, Jour. Myc. **14**: 14, 1908). Infection has been secured from *C. riparia* on *Urtica* but the spores are quite different from those included here. From these results it is assumed that there must have been some error about Holway's procedure. The name which he proposed evidently belongs here in part and with *Puccinia Grossulariae* in part.

6. **Puccinia urticata** (Link.) comb. nov.

Aecidium Urticae Schum. Enum. Pl. Saell. **2**: 222. 1803.
?*Uredo Caricis* Schum, Enum. Pl. Saell. **2**: 231. 1803.
Caeoma Urticae Schlecht. Fl. Berol. **2**: 112, 1824.
Caeoma urticatum Link. in Willd. Sp. Pl. **6**^{2}: 62. 1825.
Puccinia Caricis Schroet. Krypt.—Fl. Schles. **3**: 327. 1887. Not *P. Caricis* Reb. 1804.
Puccinia Urticae Lagerh. Mitt. Bad. Ver. **2**: 72. 1889. Not *P. Urticae* Barcl. 1887.
Dicaeoma Urticae Kuntze, Rev. Gen. **3**^{3}: 467. 1898.
?*Dicaeoma Caricis* Kuntze, Rev. Gen. **3**^{3}: 468. 1898.
Puccinia Garrettii Arth. Bull. Torrey Club. **32**: 41. 1905.

O & I. Pycnia and aecia on *Urtica* spp. (For cultures see Bot. Gaz. **29**: 270, 1900, **35**: 16, 1903: Jour. Myc. **12**: 15, 1906, **14**: 14, 1908, Mycologia **2**: 223, 1910, **4**: 17, 1912.)

II. Urediniospores broadly ellipsoid, rather large, 18–25 × 24–35 μ; wall golden-brown, 1.5–2 μ thick, rather sparsely echinulate, the pores 3, rarely 4, equatorial.

III. Teliospores mostly clavate, 15–23 × 39–71 μ, usually rounded above, the upper cell much broader and shorter than the

lower one, narrowed below into the pedicel; wall light chestnut-brown, paler below, about 1.5μ thick, much thicker above, 7–12 μ; pedicel firm, tinted, often darker than the lower portion of the spore, one half length of the spore or less.

On *Carex acutina, amplifolia, aquatilis, atherodes, Baileyi, comosa, crinita, diandra, exilis, exsiccata, laciniata, lacustris, lanuginosa, magnifica; nebraskensis, nigricans, nudata, Pseudocyperus, retrorsa, rostrata, Sartwellii, siccata, stipata, stricta, trichocarpa, viridula.*

DISTRIBUTION: Across northern United States from Connecticut, New York and Delaware to Washington, Oregon, and Utah, and in Ontario; also in Europe, Siberia, and Japan.

EXSICCATI: Barth, Fungi Columb. *2351, 2655, 3170, 3179, 3349, 3545, 3546, 3571, 3655, 3837, 3838, 3863, 3864, 4066, 4166, 4356, 4377, 4575, 4676, 4979, 5057*—3772, 3973, 4978; Barth. N. Am. Ured. *740, 770, 940, 1081, 1082, 1242*—972; Brenckle, Fungi Dakot. *12, 294*—118; Clements, Crypt. Form. Colorad. *550, 551*—601; Ellis & Ev. Fungi Columb. *1468, 1759*; Garrett, Fungi Utah, *44, 45, 129, 167, 172*; Griff, W. Am. Fungi *339*; Kellerm. Ohio Fungi, *70, 71, 192*—69; Sydow, Ured. *464, 1065, 1575*—2513.

A widely distributed and rather common *Carex* rust. The characteristic features are the moderately large urediniospores with the three, or rarely four, equatorial pores and the long clavate teliospores with the rounded upper cell which is broader and much shorter than the lower cell. On the most of the hosts listed the spores are characteristic and placed here with considerable confidence. The form of *C. nebraskensis,* formerly determined as *C. Hoodii,* was at one time named *Puccinia Garrettii* and described as having amphispores. The tendency of these spores toward thicker walls and retention of pedicels is perhaps better interpreted as a condition of slight immaturity than as a modification toward a resting condition, which we now believe to go with genuine amphispores. Both culture evidence and field observations favor the present disposition.

7. **Puccinia lysimachiata** (Link) comb. nov.

Aecidium Lysimachiae Schw. Schrift. Nat. Ges. Leipzig **1**: 67. 1822. Not *P. Lyssimachiae* Karst. 1879.

Caeoma Lysimachiae Schlecht. Fl. Berol. **2**: 113. 1824.
Caeoma lysimachiatum Link, in Willd. Sp. Pl. **6**[2]: 45. 1825.
Aecidium Lysimachiae Schlecht.; Wallr. Fl. Crypt. Germ. **2**: 252. 1833.
Puccinia Limosae Magn. Amtl. Ber. Vers. Deutsch. Naturf. u. Aerzte **1877**: 200. 1877.
Dicaeoma Lysimachiae Kuntze, Rev. Gen. **3**[3]: 467. 1898.

O & I. Pycnia and aecia on *Lysimachia* spp. (Cultures in Europe but not yet made with North American material.)

II. Urediniospores broadly ellipsoid or obovoid, 17–19 × 20–25 μ; wall cinnamon-brown, 1.5–2 μ thick, evenly and rather sparsely echinulate, the pores 3 or 4, equatorial.

III. Teliospores oblong or oblong-clavate, 15–19 × 32–45 μ, rounded or truncate at the apex, usually narrowed below, slightly constricted at the septum; wall dark chestnut-brown, somewhat paler below, 1–1.5 μ thick, much thicker above, 7–10 μ; pedicel light yellow or nearly colorless, about three-fourths length of spore.

On *Carex arcta, atratiformis brunnescens, limosa.*

DISTRIBUTION: Vermont, Connecticut, and Delaware west to Wisconsin, Nebraska, and Illinois; also in Europe.

EXSICCATI: Barth, Fungi Columb. *3848, 4153, 5064*—4152; Ellis & Ev. N. Am. Fungi, 2404.

Cultures in Europe by Magnus (1877) and by Klebahn (Jahrb. f. wissenschaft. Bot. **34**: 396, 1900) have established a connection there between a *Puccinia* on *Carex limosa* and an aecidium on *Lysimachia.* The American specimens here included agree perfectly with the European specimens and are included on the grounds of morphological similarity, even in spite of one negative attempt to make a culture from *C. limosa* on *Lysimachia.* Strong field evidence both from Dearness in Ontario and Bates in Nebraska support the connection. These aecia on *Lysimachia* are undoubtedly distinct from those on *Steironema* which are associated with telial forms on the grass *Spartina.* The aecia have been collected more frequently than the telia.

8. PUCCINIA GROSSULARIAE (Schum.) Lagerh. Ured. Herb. Fries. 60. 1895

Aecidium Rumicis β Grossulariae Pers. Synop. Fung. 207. 1801.
Aecidium Grossulariae Schum. Pl. Saell. **2**: 223. 1803.

Caeoma Grossulariatum Link, in Willd. Sp. Pl. 6²: 59. 1825.
Puccinia Pringsheimiana Kleb. Zeits. Pflanzenkr. 4: 194. 1894.
Puccinia Magnusii Kleb. Zeits. Pflanzenkr. 5: 79. 1895.
Puccinia Ribis-nigri-acutae Kleb. Zeits. Pflanzenkr. 6: 327. 1896.
Puccinia Ribesii-Pseudocyperi Kleb. Prings. Jahrb. 34: 391. 1899.
Puccinia Ribis-nigri-Paniculatae Kleb. Prings. Jahrb. 34: 393. 1899.
Puccinia albiperidia Arth. Jour. Myc. 8: 53. 1902.
Aecidium albiperidium Arth. Jour. Myc. 8: 53. 1902.
Puccinia riparia Holway, Jour. Myc. 10: 163, in part. 1904.
Dicaeoma albiperidium Arth. Proc. Ind. Acad. Science 1903: 145. 1904.
Puccinia quadriporula Arth. Bull. Torrey Club 34: 586. 1907.
Puccinia Ribesii-Caricis Kleb. Zeits. Pflanzenkr. 17: 134. 1907.
Puccinia uniporula Orton, Mycologia 4: 201. 1912.

O and I. Pycnia and aecia on *Ribes* spp. (For cultures see Jour. Myc. 8: 53, 1902, 11: 58, 1905, 12: 14, 1906; Mycologia 7: 66, 1915.)

II. Urediniospores broadly ellipsoid or obovoid, 15–21 × 19–24 μ (rarely larger, up to 25 × 34 μ); wall golden-brown, 1.5–2 μ thick, finely and evenly echinulate, the pores 3, or sometimes 4, equatorial, or sometimes wholly or in part 1, close to the hilum.

III. Teliospores broadly clavate, 15–21 × 32–58 μ, rounded or truncate at the apex, narrowed below, slightly constricted; wall cinnamon-brown, 1–1.5 μ thick, thicker at apex, 4–10 μ; pedicel one-half length of spore or less.

On *Carex acutina, aquatilis, arctata, arctata × flexilis, brunnescens, canescens, castanea, complanata, concolor, conoidea, crinita, cryptocarpa, digitalis, disperma, eburnea, festivella* (formerly det. as *festiva*), *flava, flexuosa, Goodenowii, gracillima, gynandra, Haydeni, hirtifolia, Hitchcockiana, intumescens, Kelloggii, lanuginosa, laxiflora, macrochaeta, magnifica, maritima, Mertensii, monile, nebraskensis, obtusata, pallescens, prasina, retrorsa, scabrata, sitchensis, spectabilis, squarrosa, stipata, stricta, stygia, tetanica, trisperma, typhina, virescens.*

DISTRIBUTION: Northern United States and southern Canada from Nova Scotia and New Jersey west to northern New Mexico, Oregon, and British Columbia, and in Alaska; also in Europe.

EXSICCATI: Barth. N. Am. Ured. *447, 638, 845, 945, 1048,*

1049, 1245, 1346, 1547—222, 637, 844, 944, 1025, 1047, 1152, 1244, 1345, 1446; Barth. Fungi Columb. *2350, 2447, 2555, 2556, 3060, 3758, 4148, 4461, 4664, 4962*—3757, 3843, 3928, 3940, 4147, 4264; Brenckle, Fungi Dakot. *243, 365*—301; Clements, Crypt. Colorad. Form. 596; Ellis & Ev. Fungi Columb. 1904, 2101; Kellerm. Ohio. Fungi *149*—81, 121; Kellerm. & Sw. Kansas Fungi *27*.

A *Carex* rust associated with aecia on *Ribes* is one of the most widespread species both in Europe and America. The study of these forms in America has been attended with some interesting developments. In 1901 when Arthur made the first culture in this country on *Ribes* the resulting aecia were characterized by a decidedly whitish peridium apparently quite unlike the deep orange aecia which are so abundant in North America, and the species was named *Puccinia albiperidia*. During the next few years every effort was made to determine the possible significance of the pale forms obtained by cultures. After six or seven years of culture work it was concluded that the greenhouse conditions such as shade and moist air coupled with a slower development of the fungus tended to produce the differences known to exist between the culture and field specimens. Plants infected indoors and then transferred to the garden gave practically the same appearance as natural infections. The question as to the identity between American and European material remained unsettled and the American rust was still called *Puccinia albiperidia*. In Europe several races were recognized and several names such as *Puc. Ribis-nigri-acutae* and *Puc. Ribesii-Pseudocyperi* proposed by Klebahn came into use. Just about the time that the conclusion was being reached that all *Carex* rusts both in Europe and America, having their aecial stages on *Ribes,* were races of one large species for which the name *Puc. Grossulariae* was the oldest and most appropriate name, another disturbing factor came to light.

While making a special study of the *Carex* rusts possessing 1-celled teliospores (*Uromyces* or *Nigredo*) some specimens were found having one pore, near the hilum, in the urediniospores (see Rhodora **12**: 124–127, 1910). At first this *Uromyces* was known only on *Carex tenuis* but later it was found on *C. gracillima.*

The discovery of such an unusual pore arrangement in a *Uromyces* on a sedge led to a search for urediniospores with this type of pore location in a *Puccinia*. They were found in connection with *Puccinia* forms on the two hosts mentioned and also on *C. pubescens* and *C. pallescens* all of which are hosts for the *Ribes* rust. The urediniospores which have previously been supposed to belong with the telia known to infect *Ribes* possessed three equatorial pores. The discovery of the new pore arrangement even on specimens which had been used for successful cultures suggested that two species must be intermixed. At first the tendency was toward a belief that here might exist two species both with aecia on *Ribes,* the usual one with three equatorial pores and bright colored aecia widespread in both Europe and America, and a less common but perhaps valid one with the single basal pore and pale aecia. Nothing could have been more natural than the suspicion that a structural character in the uredinial stage had now been discovered to accompany the somewhat uncertain character of the aecial stage and that *Puc. albiperidia* was entitled to specific standing. The constant presence of urediniospores with the three equatorial pores in all culture material used for successful inoculations on *Ribes* finally led to the conclusion that the telial stage of which they were a part could account for the cultures, that *Puc. albiperidia* and *Puc. Grossulariae* must after all be synonymous. This view left the form with the basal pore unnamed and unconnected. About this time C. R. Orton in making a study of correlations in the genera *Puccinia* and *Uromyces* reviewed the matter, decided the 1-pored form was a valid species correlated with *Uromyces uniporulus* and supplied the name *Puccinia uniporula* (Mycologia 4:201, 1912). Then began definite steps to learn more of its standing through cultures. It is very difficult to secure specimens in which all of the urediniospores have a single basal pore but in 1915 Arthur reports (Mycologia 8:130, 1916) that material which may be considered representatives of pure *Puc. uniporula* produced infection on *Ribes* giving aecia identical with those grown previously from material possessing three equatorial pores. There seems to be such a remarkable association of the two types of urediniospores in material capable of producing infection on *Ribes* that the pos-

sibility that we may be dealing with a species having dimorphic urediniospores is tentatively accepted. Whether this will alter the present view of the taxonomic value of pore characters or whether we are in error in uniting these two forms can be revealed only by further investigation. For further discussion of the pore problem the reader is referred to *Mycologia* **7**: 28–33 (1915).

9. **Puccinia eminens** sp. nov.

O & I. Pycnia and aecia unknown.

II. Urediniospores broadly ellipsoid or obovoid, 15–21 × 23–32 μ; wall cinnamon-brown, about 1.5 μ thick, evenly and rather sparsely echinulate, the pores 3, equatorial.

III. Telia roundish or oval, 0.4–1 mm. long, early naked, chocolate-brown, teliospores broadly clavate, 13–24 × 45–67 μ; slightly constricted at the septum, rounded or more often narrowed above, narrowed below; wall chestnut-brown, 1.5–2 μ thick, much thicker above, 7–16 μ; pedicel colorless, length of spore or less.

On *Carex saximontana* Mack. (*C. durifolia subcostrata* Bates).

Type collected in Colorado, May 22, 1909. *E. Bethel;* also collected at Fort Collins, Colorado, May 24, 1896, *C. F. Baker.*

One of the most characteristic features about this species is the broad prominent telial sorus. The urediniospores agree with *Puc. urticata* in pore arrangement but differ in being smaller and darker colored. Acting upon a suggestion made by Mr. E. Bethel an attempt has been made to infect this host, *Carex saximontana,* with aecia from *Ribes longiflorum* but without success (Mycologia **8**: 130, 1916). Specimens may have been distributed as on *Carex Backii* or *C. durifolia* but the Rocky Mountain plant passing under those names is *C. saximontana* Mack.

10. PUCCINIA MICROSORA Körn; Fuckel, Fungi Rhenani *2637.* 1874

Dicaeoma microsorum Kuntze, Rev. Gen. 3^3: 469. 1898.

O & I. Pycnia and aecia unknown.

II. Uredinia of the typical sort oval or oblong, 0.5–1.5 mm. long, bullate, long covered by the epidermis; urediniospores of the typical sort ellipsoid, 20–26 × 26–30 μ; wall pale yellow or nearly colorless, 1–1.5 μ thick, strongly and sharply echinulate,

the pores obscure, apparently 4, equatorial: uredinia of the modified sort (amphisori) roundish or oval, 0.3–0.6 mm. long, long covered by the epidermis; urediniospores of the modified sort (amphispores) broadly spatulate or obovoid, 20–28 × 32–48 μ; wall chestnut-brown, 2–3 μ thick, slightly thicker above 3–5 μ, sparsely and inconspicuously verrucose, the pores 2 or sometimes 3, equatorial; pedicel persistent, colorless, about length of spore.

III. Teliospores common in the amphisori, oblong or lanceolate, 13–19 × 35–50 μ, rounded or often narrowed above and below, slightly or not constricted at the septum; wall pale yellow, 1–1.5 μ thick, somewhat thicker at apex 2–4 μ; pedicel colorless; about one-third length of spore or less.

On *Carex exsiccata, Frankii, lurida, scabrata, Sprengelii, Tuckermani* (on *C. vesicaria* in Europe).

Distribution: Known only from isolated localities in the mountains of Pennsylvania, West Virginia, Virginia, in northern Wisconsin, and on the coast of Oregon; also in Europe.

The discovery, recognition, and finding of additional specimens of this species makes an interesting story. The first specimen was sent from West Virginia by Dr. John L. Sheldon and was on *Carex Frankii.* This being a common host for *Puc. Sambuci* it was examined with the expectation of finding that species. The examination, however, showed only 1-celled, chestnut-brown spores, now known to be amphispores, but which were then taken to be teliospores of some *Uromyces.* They agreed with no known species and the specimen was laid aside as a possible new species. Several years elapsed before anything further came to light. Then Dr. J. J. Davis sent in specimens on *Carex scabrata* and *C. Tuckermani* which were at once recognized as unusual since they possessed three types of spore forms. Urediniospores of an ordinary sort and two-celled nearly colorless teliospores, indicating a *Puccinia* relationship, were present. The most numerous spores, however, were single celled, chestnut-brown, with a thickened apex. Their shape, size, and color indicated at once that they could not be considered mesospores. To be amphispores the wall should have some sort of surface marking and germ pores should be evident and further examination showed clearly that they qualified. The West Virginia specimen was then thought of and a re-examination indicated clearly that the supposed *Uromyces* telio-

spores agreed in every respect with the amphispores of the Wisconsin specimens and that the colorless *Puccinia* spores had been overlooked. The situation was still puzzling but it was evident that another sedge rust with amphispores was added to our list. To Dr. J. J. Davis is due the credit for first suggesting the possibility that his specimens might represent *Puc. microsora* Körn. A comparison of the description in Fuckel, Sym. Myc. 3: 14 (1875) and a later examination of the specimen in Fungi Rhenani *2637* (1874) left no doubt as to the correctness of the suggestion. The next specimens were soon collected in central Pennsylvania and additional ones have since been sent in from Oregon and Virginia, thus showing it to be present in numerous widely separated localities.

11. PUCCINIA MINUTISSIMA Arth. Bull. Torrey Club 34: 587. 1907

Aecidium Nesaeae Gerard, Bull. Torrey Club 4: 47. 1873. Not *P. Nesaeae* Ellis & Ev. 1895.

O & I. Pycnia and aecia on *Decodon verticillatus*. (For cultures see Mycologia 7: 245. 1915.)

II. Urediniospores globoid or broadly ellipsoid, very small, 12–18 × 16–21 μ; wall golden-brown, 1–1.5 μ, finely echinulate, the pores, 2, slightly superequatorial.

III. Teliospores oblong-clavate, 15–22 × 39–64 μ, slightly constricted at the septum, the apex rounded or obtuse, narrowed below; wall dark chestnut-brown, 1–1.5 μ thick, much thicker above, 9–13 μ; pedicel slightly tinted, about one-half length spore.

On *Carex aquatilis, lasiocarpa*.

DISTRIBUTION: In swamps or bogs of northeastern United States, from Massachusetts and Delaware west to Indiana and Wisconsin; also in Ontario.

EXSICCATI: Barth. N. Am. Ured. *801–951*—1001; Barth. Fungi Columb. 4063, 4102; Ellis & Ev. Fungi Columb. *258* (in part) *1382*; Kellerm. Ohio Fungi 91; Sydow, Ured. *2419*—2549.

This species is especially characterized by the small urediniospores in association with teliospores which are of average size. Its aecial connection also serves to set it apart from any other

species. It is evidently a bog form since both aecial and telial hosts are limited in distribution to swamps, bogs or lake margins.

12. Puccinia universalis Arth. Jour. Myc. **14**: 21, 1908

Aecidium Dracunculi Thüm. Bull. Soc. Nat. Moscow **58**: 212. 1878. Not *P. Dracunculi* Auerswald, 1850.

O & I. Pycnia and aecia on *Artemisia* spp. (For cultures see Jour. Myc. **14**: 21. 1908; Mycologia **2**: 224. 1910.)

II. Urediniospores broadly ellipsoid, $15–20 \times 20–26\,\mu$; wall cinnamon-brown, $1–1.5\,\mu$ thick, rather finely echinulate, the pores 2, equatorial or approximately equatorial.

III. Teliospores clavate-oblong, $16–26 \times 35–55\,\mu$, slightly or not constricted at the septum, rounded or obtuse above; wall dark chestnut-brown above, somewhat paler below, $1.5–2\,\mu$ thick, much thicker above $7–12\,\mu$; pedicel tinted, one half length of spore or more.

On *Carex diandra, Douglasii, filifolia, Geyeri, heliophila, multicaulis, obtusata, oligocarpa* (Wis.), *petasata, praegracilis, Rossii, stenophylla.*

Distribution: Semi-arid regions, North Dakota, and Montana south to Colorado and Utah, locally in Iowa and Wisconsin; also in Asia.

Exsiccati: Barth. N. Am. Ured. *273, 475, 1080, 1476*—668, 872; Barth. Fungi Columb. *2446, 4275, 4376, 4675, 4980*—4165, 4469, 4765; Brenckle, Fungi Dakot. *106*; Clements, Crypt. Form. Colorad. *593*; Ellis & Ev. N. Am. Fungi *2219*; Ellis & Ev. Fungi Columb. *1641*—1664; Griff. W. Am. Fungi *277a, 360, 360a;* Syd. Ured. *1712*—2435.

One of the most interesting features about this species is its distribution. The fact that it occurs in the central part of North America and also in central Asia and that in each locality the original telial host is *Carex stenophylla* is worthy of note. The probable connection between these aecia and telia was suspected independently in the widely separated locations, by Dr. W. Tranzschel in Turkestan and by Rev. J. M. Bates in Nebraska, and numerous cultures have been since made but only the hosts, *C. stenophylla* and *A. dracunculoides* have been employed successfully. All of the other species of *Carex* are included here

with some uncertainty on account of the lack of culture evidence. They are included on the grounds of morphological similarity. The collection of *C. oligocarpa* is from Wisconsin and is further east than any of the others or any of the aecial collections but appears to belong here. With the exception of a single collection of pycnia on *Artemisia* from Iowa this stage of the species is not known to extend east of the Dakotas and Nebraska.

13. PUCCINIA PHRYMAE (Halst.) Arth. Jour. Myc. **14**: 22. 1908

Aecidium Phrymae Halst. Jour. Myc. **2**: 52. 1886.

O & I. Pycnia and aecia on *Phryma leptostachya*. (For cultures see Jour. Myc. **14**: 22, 1908.)

II. Urediniospores obovoid or broadly ellipsoid, 13–18 × 18–23 µ; wall light cinnamon-brown, 1–1.5 µ thick, finely and rather inconspicuously echinulate, the pores 2, in the upper part.

III. Teliospores clavate oblong, 12–18 × 29–45 µ, roundish or obtuse above, usually slightly narrowed below, slightly constricted at the septum; wall chestnut-brown, 1–1.5 µ thick, much thicker above, 7–13 µ; pedicel nearly colorless, about length of spore.

On *Carex Sprengelii* (*longirostris*).

DISTRIBUTION: In the telial stage known only from Madison, Wis., and Valentine, Nebr., the aecia have been collected also in Iowa, South Dakota, and New York.

EXSICCATI: Barth. N. Am. Ured. *956, 1067*—253; Barth. Fungi Columb. *3958*.

This is a restricted species as to hosts both for the aecial and telial stages. The urediniospores are very like those of *Puc. asterum* but differences in the teliospores and the interval between the aecial host families seem sufficient to maintain this as a good species.

14. **Puccinia asterum** (Schw.) comb. nov.

Aecidium asterum Schw. Schr. Nat. Ges. Leipzig **1**: 67. 1822.

Aecidium Solidaginis Schw. Schrift. Nat. Ges. Leipzig **1**: 68. 1822.

Caeoma asteratum Link, in Willd. Sp. Pl. **6**²: 51. 1825.

Caeoma (*Aecidium*) *erigeronatum* Schw. Trans. Am. Phil. Soc. II. 4: 292. 1832.

Aecidium Bellidiastri Unger, Exanth. Pfl. 109. 1833.

Aecidium Asteris Thüm. Myc. Univ. *935*. 1878.
Aecidium Lynosyridis Lagerh. Mitth. Bad. Bot. Ver. **46**. 1888.[7]
Puccinia extensicola Plowr. Monog. Ured. 181. 1889.
Puccinia firma Diet. Hedwigia **31**: 216. 1892.
Puccinia vulpinoidis Diet. & Holw.; Diet. Bot. Gaz. **19**: 304. 1894.
Puccinia tecta Ellis & Barth. Erythea **4**: 79. 1896.
Puccinia fusiformis Diet. Hedwigia **36**: 29. 1897.
Aecidium microsporum Diet. Hedwigia **36**: 34. 1897.
Dicaeoma extensicolum Kuntze, Rev. Gen. 3^3: 468. 1898.
Dicaeoma firmum Kuntze, Rev. Gen. 3^3: 468. 1898.
Dicaeoma vulpinoidis Kuntze, Rev. Gen. 3^3: 471. 1898.
Aecidium Grindeliae Sydow, Hedwigia Beibl. **40**: 1. 1901.
Puccinia Caricis-Erigerontis Arth. Jour. Myc. **8**: 53. 1902.
Puccinia Caricis-Asteris Arth. Jour. Myc. **8**: 54. 1902.
Puccinia Caricis-Solidaginis Arth. Bot. Gaz. **35**: 21. 1903.
Puccinia Dulichii Sydow. Monog. Ured. **1**: 684. 1903.
Puccinia Linosyridi-Caricis Ed. Fisher, Beitr. Krypt. Schweiz 2^2: 275. 1904.
Dicaeoma Caricis-Asteris Arth. Proc. Ind. Acad. Sci. **1903**: 147. 1904.
Dicaeoma Caricis-Erigerontis Arth. Proc. Ind. Acad. Sci. **1903**: 147. 1904.
Dicaeoma Caricis-Solidaginis Arth. Proc. Ind. Acad. Sci. **1903**: 147. 1904.
Dicaeoma Dulichii Arth. Proc. Ind. Acad. Sci. **1903**: 147. 1904.

O & I. Pycnia and aecia on *Aster, Doellingeria, Erigeron, Eucephalus, Euthamia, Grindelia, Leptilon, Oreochrysum* and *Solidago* spp. (For cultures see Jour. Myc. **8**: 53–55, 1902; Bot. Gaz. **35**: 15, 16, & 21, 1903: Jour. Myc. **11**: 58, 1904; Mycologia **2**: 224, 1909.)

II. Urediniospores globoid or broadly ellipsoid, 12–19 × 16–23 μ; wall light cinnamon-brown, 1–1.5 μ thick, finely echinulate, the pores 2, in the upper part.

III. Teliospores clavate or clavate-oblong, 12–20 × 35–50 μ, slightly or not constricted at the septum, usually rounded above; wall chestnut-brown, 1–1.5 μ thick, much thicker above, 5–10 μ; pedicel tinted next to the spore, about one half length of the spore.

7 Reference not verified.

On *Carex alata, albolutescens, athrostachya, brevior, bromoides, canescens, cephaloidea, cephalophora, Crawfordii, cristatella, Deweyana, diandra, disperma, festivella* (formerly det. as *festiva*), *festucacea, foenea, gravida, Hookeriana, Houghtonii, interior, Jamesii, laeviculmis, Leavenworthii, Leersia, Muhlenbergii, Muskingumensis, oligocarpa, Pennsylvanica, planostachys, prairea, retrorsa, rosea, Rossii, scoparia, sparganioides, sterilis, stipata, suberecta, subfusca, Swanii, tenera, triangularis, tribuloides, trisperma, umbellata, varia, viridula, vulpinoidea* (also on *Dulichium arundinaceum*).

DISTRIBUTION: Common from Nova Scotia and Virginia west to the Pacific Coast, less common southward to Alabama and Texas, and in Alaska; also in South America and Europe.

EXSICCATI: Barth. N. Am. Ured. *25, 267, 535, 624, 651, 732, 733, 775, 827, 1031, 1032, 1140, 1180, 1226*—26, 226, 227, 228, 334, 421, 534, 623, 625, 626, 731, 824, 825, 826, 828, 829, 931, 976, 1029, 1030, 1135, 1136, 1138, 1139, 1337, 1442, 4565; Barth. Fungi Columb. *2366, 2574, 3743, 3862, 4274, 4455, 4564, 4755, 4766*—2302, 2448, 2656, 3250, 3251, 3352, 3454, 3455, 3547, 3548, 3744, 3839, 3932, 4053, 4054, 4142, 4257, 4258; Brenckle, Fungi Dakot. *241, 364, 364a*—107, 341, 341*a*; Carleton, Ured. Am. 45; Clements, Crypt. Form. Colorad. 692; Ellis & Ev. Fungi Columb. *1667, 1847, 4143*—64, 1391, 1502, 1705, 1707, 1708, 1955; Ellis, N. Am. Fungi 1019; Ellis & Ev. N. Am. Fungi 2402b; Garrett, Fungi Utah. *66*—65, 131, 155; Griff, N. Am. Fungi *277*—370; Kellerm. Ohio Fungi *89, 174*—150, 151; Sydow, Ured. *2132, 2386, 2411, 2412*—2515; Rab.-Wint.-Paz. Fungi eur. *3833*.

In its present form this is a comprehensive species including several forms which heretofore have passed as good species. Using the aecial hosts chiefly as a guide three distinct forms were recognized during the early stages of culture work in this country. These three forms were named *Puc. Caricis-Asteris, Puc. Caricis-Solidaginis,* and *Puc. Caricis-Erigerontis,* the names indicating the aecial connections. In view of the close relationship of the aecial hosts, the similarity of structure of the uredinial and telial stages, and certain cross cultures it now seems best to consider these forms as races of a single species. An examination of the long list of synonyms reveals several other items of interest. *Puc-*

cinia vulpinoidis will be noted as occurring on the list. This is a form in which the telia are long covered by the epidermis and it was not suspected for many years that it might belong in this group. Numerous cultures were attempted on a variety of plants known to bear aecia but without success. A careful morphological study, fortunate field observations, together with a consideration of the range of hosts finally led to the belief that it belonged here. Cultures as well as hosts indicate that it is the *Solidago* race, all attempts to cultivate it on *Aster* having failed (See Mycologia **7**: 79–81). The long covered condition of the telial sorus seems to be associated with structural features of the host. Cultures which have shown that *Puc. Dulichii* is but a race of this large species are interesting because it is the only case where a *Carex* rust has been shown to occur on a telial host not belonging to the genus *Carex*. The report of its culture will be found in the reference to Mycologia above cited.

15. PUCCINIA PECKII (De Toni) Kellerm. Jour. Myc. **8**: 20. 1902

Aecidium Oenotherae Mont. Hist. Chile **8**: 37. 1852. Not *Puccinia Oenotherae* Vize. 1877.

Aecidium Oenotherae Peck, Ann. Rep. N. Y. State Mus. **23**: 60. 1873.

Aecidium Peckii De Toni, in Sacc. Syll. Fung. **7**: 790. 1888.

Puccinia ludibunda Ellis & Ev. Proc. Phil. Acad. **1893**: 153. 1893.

Aecidium Gaurae Ellis & Ev. Erythea **1**: 205. 1893.

Dicaeoma ludibundum Kuntze, Rev. Gen. 3^3: 469. 1898.

Dicaeoma Pecki Arth. Proc. Ind. Acad. Sci. **1903**: 149. 1904.

O & I. Pycnia and aecia on *Gaura, Onagra, Meriolix,* and *Pacylophus* spp. (For cultures see Jour. Myc. **8**: 20. 1902; Bot. Gaz. **35**: 13. 1903. Jour. Myc. **11**: 58. 1905. **12**: 15. 1906.)

II. Urediniospores broadly ellipsoid or obovate, $15–20 \times 21–26\,\mu$; wall golden-brown, $1–1.5\,\mu$, finely echinulate, the pores 2, in the upper part.

III. Teliospores clavate-oblong, $13–19 \times 32–55\,\mu$, the apex rounded or truncate, usually narrowed at the base, slightly constricted at the septum; wall chestnut-brown, paler below, about $1.5\,\mu$, thicker at apex $7–11\,\mu$; pedicel one half to once length of spore, nearly colorless.

On *Carex Asa-Grayii, chordorrhiza, Hookeriana, lanuginosa, Muhlenbergii, occidentalis, retrorsa, rostrata, siccata, sparganioides, trichocarpa, Willdenowii.*

DISTRIBUTION: Widely distributed from Maine and Virginia west to the Pacific Coast, also south to Alabama and New Mexico; especially abundant from Ohio to Colorado and the Dakotas.

EXSICCATI: Barth. Fungi Columb. *2569, 2570, 3850, 3956*—3460, 3563, 3669, 3955, 4157; Barth. N. Am. Ured. *47, 759, 1058*—53, 252, 560, 652, 955, 1361, 1563; Brenckle, Fungi Dakot. *65*—65a, 112; Carleton. Ured. Am. *5*; Ellis & Ev. Fungi Columb. *1651, 1954*—1604, 1907; Ellis & Ev. N. Am. Fungi *3243*; Ellis N. Am. Fungi 1016; Kellerm. Ohio Fungi *28, 194*—17; Sydow, Ured. *1176, 1576*—2325.

A species of rather common occurrence and of wide distribution. Numerous cultures have clearly established the life history. The urediniospores have the same pore arrangement as those of *Puc. asterum* but the spores are larger. The telia are characterized by being unusually broad for their length, they are oval or even roundish, whereas most sedge rusts have oblong or linear telial sori. On *Carex trichocarpa* the sori of this species are frequently intermingled with those of *Puc. Sambuci.* The small roundish sori of *Puc. Peckii* are usually easily distinguished from the robust elongated sori of *Puc. Sambuci,* even without microscopic characters which would make separation certain.

16. PUCCINIA PATRUELIS Arth. Mycologia **1**: 245. 1909.

?*Caeoma* (*Aecidium*) *hieraciatum* Schw. Trans. Am. Phil. Soc. II. **4**: 292. 1832.

?*Aecidium* (*Caeoma*) *hieraciatum* Schw. Trans. Am. Phil. Soc. II. **4**: 309. 1832.

Aecidium Compositarum Lactucae Burrill; DeToni, in Sacc. Syll. Fung. **7**: 799. 1888.

?*Aecidium crepidicolum* Ellis & Gall. Jour. Myc. **6**: 31. 1890.

Puccinia Opizii (Bubak, misapplied by) Arth. Jour. Myc. **13**: 194. 1907.

O & I. Pycnia and aecia on *Adopogon* (*Cynthia, Krigia*) *Agoseris, Crepis, Lactuca, Hieracium,* and *Prenanthes* (*Nabalus*) spp. (For cultures see Jour. Myc. **13**: 194, 1907, Mycologia **1**: 245, 1909.)

II. Urediniospores ellipsoid or obovoid 15–20 × 20–26 μ; wall golden-brown, about 1.5 μ thick, moderately echinulate, the pores 2, in the upper part of the spore.

III. Teliospores narrowly clavate-oblong, 15–21 × 32–59 μ, rounded or truncate above, slightly or not constricted at the septum; wall chestnut-brown, somewhat paler below, 1–1.5 μ thick, much thicker at apex 5–13 μ; pedicel tinted next to the spore, about three-fourths length of the spore.

On *Carex aenia, brunnescens, Hoodii, illota, praegracilis, praticola, Reynoldsii, Sartwellii, siccata, Sprengelii.*

DISTRIBUTION: Michigan and Illinois westward to Utah, Oregon, and British Columbia.

EXSICCATI: Barth. N. Am. Ured. *758, 1065, 1066, 1165, 1264*—702; Barth. Fungi Columb. *3070, 3765, 4366*—3101, 3953, 3954, 4860; Brenckle, Fungi Dakot. *111, 242*—111a, 111b; Clements, Crypt. Form. Colorad. *314*; Ellis & Ev. Fungi Columb. *1902*—1601; Ellis & Ev. N. Am. Fungi. 2993, 3054; Griff, W. Am. Fungi *277c, 339a*—372a; Sydow, Ured. *2323*.

It is here assumed that all the American forms having aecia on members of the Cichoriaceae are referable to a single species. In 1906 cultures were made from an undetermined *Carex* on various species of *Lactuca*. At that time it was believed that the species was the same as one in Europe known to have aecia on *Lactuca* and the name proposed by Bubak, *Puc. Opizii,* was used. Two years later successful cultures were made with Colorado material on *Agoseris* and without suspecting its possible relationship to the so-called *Puc. Opizii* the name *Puc. patruelis* was proposed. When a more comprehensive study was made it became apparent that the American and European species are not identical but that all American forms with aecia on the closely related genera of the Cichoriaceae are without doubt the same species. *Puc. patruelis* then becomes the name, the Schweinitzian names above listed being doubtfully included.

17. PUCCINIA SAMBUCI (Schw.) Arth. Bot. Gaz. **35**: 15. 1903

Aecidium Sambuci Schw. Schr. Nat. Ges. Leipzig **1**: 67. 1822.
Caeoma (*Aecidium*) *sambuciatum* Schw. Trans. Am. Phil. Soc. II. **4**: 294. 1832.

Puccinia Bolleyana Sacc. Syll. Fung. **9**: 303. 1891.

Puccinia Atkinsoniana Diet.; Atkinson, Bull. Cornell Univ. **3**: 19. 1897.

Dicaeoma Bolleyanum Kuntze, Rev. Gen. **3**^{3}: 468. 1898.

Puccinia Thompsoni Hume, Bot. Gaz. **29**: 352. 1900.

O & I. Pycnia and aecia on *Sambucus* spp. (For cultures see Bot. Gaz. **35**: 14, 1903; Jour. Myc. **12**: 14, 1906, **13**: 195, 1907; Mycologia **1**: 233, 1909.)

II. Urediniospores lenticular or ellipsoid, 17–21 × 23–32 μ; wall light chestnut-brown, about 1.5 μ thick, rather finely echinulate, the pores 2, in the upper part.

III. Teliospores clavate-oblong or clavate, 15–25 × 42–65 μ, rounded above, usually narrowed below, somewhat constricted at the septum; wall chestnut-brown, 1.5–2 μ thick, much thicker at apex 7–13 μ; pedicel nearly colorless, about length of spore.

On *Carex Asa-Grayii, bullata, comosa, crinita, crus-corvi, Frankii, intumescens, lupuliformis, lupulina, lurida, trichocarpa.*

DISTRIBUTION: Eastern United States and Southern Canada from Nova Scotia and Wisconsin southward to Florida and Texas.

EXSICCATI: Barth. N. Am. Ured. *1569*; Barth. Fungi Columb. *3860*, *4865*—3351; Kellerm. Ohio Fungi *57*, *88*, *148*—3.

A well-defined species both from the point of view of structural characters and aecial connections. It is characterized in the telial stage by the large well-developed sori and by the broad robust spores which are so well rounded above. The usual lenticular shape of the urediniospores is also especially characteristic of this species. No similar species has ever been reported from Europe.

18. PUCCINIA CARICIS-STRICTAE Dietel, Hedwigia **28**: 23. 1889

Uromyces Caricis Peck, Ann. Rep. N. Y. State Mus. **24**: 90. 1872. Not *Puccinia Caricis* Reb. 1804, or Schroet, 1887.

O & I. Pycnia and aecia unknown.

II. Urediniospores of the typical sort, ellipsoid or obovate, 13–20 × 20–25 μ; wall light cinnamon-brown, about 1.5 μ thick, finely and moderately echinulate, the pores 2, opposite, slightly below the equator; urediniospores of the modified sort (amphispores) globoid, obovate, or ellipsoid, 17–24 × 21–31 μ; wall dark cinna-

mon-brown, 1.5–2.5 μ thick, finely verrucose, the pores 2 slightly below the equator; pedicel colorless, semi-persistent, once or twice length of spore.

III. Teliospores clavate-oblong, 16–21 $\times$ 32–56 μ, usually rounded above, narrowed or rounded below, slightly constricted; wall light chestnut-brown 1–1.5 μ thick, much thicker above, 5–10 μ; pedicel nearly colorless, length of spore or less.

On *Carex stricta*.

Distribution: Northeastern states from Massachusetts to New York and Delaware.

Exsiccati: Barth. N. Am. Ured. *1033*; Thüm. Myc. Univ. *746*.

An interesting species on account of the presence of amphispores. The amphispores agree with the urediniospores in the arrangement of the pores but differ in being darker colored, in having verrucose instead of echinulate markings, and semi-persistent pedicels. Several collections without amphispores might be included based on the characters of the uredinial and telial stages but not without some uncertainty. A specimen from Connecticut and another from New York, both on *C. stricta*, with only urediniospores and teliospores, doubtless belong here but a specimen from Mississippi on *C. lacustris* has not been included. In spite of an essential agreement in urediniospore characters the geographical distribution, host relations, and lack of amphispores makes the situation too uncertain to list this host. The amphisporic collections are all on *Carex stricta* and are from the following localities: Seaford, Del., *Jackson;* Saratoga County and Albany, N. Y., *Peck;* Wellesley, Mass., *Seymour;* Southold, N. Y., *Latham.* Peck's original name *Uromyces Caricis* was based upon his error of taking amphispores to be one-celled teliospores.

19. Puccinia karelica Tranz. Acad. Sci. St. Petersburg Bot. **2**: 16. 1904

?*Aecidium Trientalis* Tranz.; Gobi & Tranz. in Scripta Bot. Hort. Imp. Petrop. **3**: 116. 1891.

O & I. Pycnia and aecia on *Trientalis* sp. (Cultures in Europe but not yet made with North American material although supported by field evidence.)

II. Urediniospores globoid or broadly ellipsoid, 16–19 $\times$ 20–24 μ; wall cinnamon-brown, 2–2.5 μ thick, finely and moderately echinulate, the pores 3–5, scattered.

III. Teliospores clavate-oblong, $13–21 \times 26–48\,\mu$, usually rounded above, rounded or narrowed below, slightly constricted at the septum; wall chestnut-brown, $1–1.5\,\mu$ thick, much thicker above, $7–12\,\mu$; pedicel tinted, about one-half length of spore.

On *Carex canescens, paupercula.*

DISTRIBUTION: Nova Scotia to New York and Wisconsin.

The name *Puccinia karelica* Tranz. is applied with some doubt to the *Carex* rust here described. Tranzschel has cultured a form on *Carex limosa* to *Aecidium Trientalis* to which he has given the name *Puc. karelica.* Fraser in Nova Scotia has found good field evidence to the effect that a rust on *Carex paupercula* is connected with an aecial form on *Trientalis americana.* On the strength of the probability that the European and American forms belonging to aecia on *Trientalis* are the same the specific name *karelica* has been taken up. That which makes it seem uncertain is the fact that we find in the *Carex paupercula* rust 3 to 5 scattered pores while Tranzschel states that his form which produces *Aecidium Trientalis* is indistinguishable from *Puccinia Limosae* which has 3 to 4 equatorial pores.

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9. eminens	macrospora, 3
10. microsora	microsora, 10
11. minutissima	minuta, 5
12. universalis	minutissima, 11
13. Phrymae	patruelis, 16
14. asterum	Peckii, 15
15. Peckii	Phrymae, 13
16. patruelis	Sambuci, 17
17. Sambuci	spatiosa, 4
18. Caricis-strictae	universalis, 12
19. karelica	urticata, 6

Index to the Rust Names Listed as Synonyms

INDEX TO RUSTS OCCURRING ON THE VARIOUS SPECIES OF CAREX[8]

[8] Only the specific names are used since the hosts all belong to *Carex* and the rusts to *Puccinia*. *Carex* names italicized are regarded as synonyms.

Kelloggii W. Boott
  Grossulariae, 8

laciniata Boott
  urticata, 6
lacustris Willd.
  minuta, 5
  urticata, 6
laeviculmis Meinsch.
  asterum, 14
lanuginosa Michx.
  Grossulariae, 8
  Peckii, 15
  urticata, 6
lasiocarpa Ehrh.
  minutissima, 11
laxiflora Lam.
  Grossulariae, 8

macrochaeta C. A. Meyer
  Grossulariae, 8
magellanica Auth. = paupercula Michx.
magnifica Dewey
  Grossulariae, 8
  urticata, 6
marcida Boott = praegracilis W. Boott
maritima O. F. Mueller
  Grossulariae, 8
Mertensii Prescott

nebraskensis Dewey
  Grossulariae, 8
  urticata, 6
nigricans C. A. Meyer

obtusata Lilj.
  Grossulariae, 8
  universalis, 12
occidentalis Bailey

pallescens L.
  Grossulariae, 8
paupercula Michx.
  karelica, 19
Pennsylvanica Lam.
  asterum, 14
petasata Dewey
  universalis, 12

Leavenworthii Dewey
  asterum, 14
Leersia
  asterum, 14
Liddoni Boott = petasata Dewey
limosa L.
  lysimachiata, 7
longirostris Torr. = Sprengelii Dewey
lupuliformis Sart.
  Sambuci, 17
lupulina Muhl.
  Sambuci, 17
lurida Wahl.
  microsora, 10
  Sambuci, 17

  Grossulariae, 8
mirata Auth. = exsiccata Bailey
monile Tuckerm.
  Grossulariae, 8
Muhlenbergii Schk.
  asterum, 14
  Peckii, 15
multicaulis Bailey
  universalis, 12
muskingumensis Schw.
  asterum, 14

  atro-fusca, 2
  urticata, 6
nudata W. Boott
  urticata, 6

  Peckii, 15
oligocarpa Schk.
  asterum, 14
  universalis, 12

  atro-fusca, 2
  patruelis, 16
  universalis, 12
prairea Dewey
  asterum, 14
prasina Wahl.
  Grossulariae, 8
pratensis Drej. = praticola Rydb.

THE PENNSYLVANIA STATE COLLEGE,
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NEW SPECIES OF PERIDERMIUM

GEO. G. HEDGCOCK AND N. REX HUNT

A description is given in this paper of five new species of foliicolous *Peridermium* on pine in the eastern United States. The first three species have been proven by the writers by inoculations with the aeciospores under controlled conditions in greenhouses to be the aecial forms of species of *Coleosporium*. These are described and named to distinguish them from other species of the form genus *Peridermium* on pine needles. Types of these species have been deposited in the pathological collections of the Department of Agriculture at Washington, D. C.

1. **Peridermium ipomoeae** sp. nov., the aecial form of *Coleosporium ipomoeae* (Schw.) Burrill

Pycnia amphigenous, scattered or frequently numerous and arranged in rows, usually on the same side with or opposite to the aecia on light or yellow green[1] spots in the needles, olivaceous black, 0.11 to 0.36 mm. broad by 0.28 to 0.64 mm. long, averaging 0.24 by 0.41 mm.

Aecia flattened laterally, scattered, usually in a single row, 0.24 to 0.56 mm. high by 0.88 to 2.32 mm. long, averaging 0.4 by 1.6 mm.; peridial cells ovoid to elliptic or rhomboid in face view, mostly overlapping, 16 to 26 by 18 to 47 μ, averaging 21 by 41 μ, with walls 2 to 5 μ thick, the inner closely and finely verrucose; aeciospores ovoid to ellipsoid, 16 to 20 by 22 to 27 μ, averaging 18 by 25 μ, walls colorless and verrucose with somewhat deciduous tubercles 1 to 2 μ in diameter and 1 to 3 μ high.

Peridermium ipomoeae has been collected on the needles of the following species of pine:

On *Pinus echinata* Mill. in Alabama, Arkansas, Georgia, North Carolina, South Carolina, Texas, and Virginia.

On *Pinus palustris* Mill. in Florida and South Carolina.

[1] Colors used are those given in Color Standards and Nomenclature by Robert Ridgway, Washington, D. C., 1912.

On *Pinus rigida* Mill. in Georgia, Maryland, Pennsylvania, and South Carolina.

On *Pinus taeda* L. in Alabama, Arkansas, Florida, Georgia, and South Carolina.

The type of the species is Forest Pathology *22217*, collected by Hedgcock on *Pinus echinata* at East Point, Atlanta, Ga., April 26, 1916.

2. **Peridermium terebinthinaceae** sp. nov., the aecial form of *Coleosporium terebinthinaceae* (Schw.) Arthur

Pycnia amphigenous, few, more or less aggregated near to or on opposite sides from the aecia on the needles, burnt umber to blackish brown, 0.15 to 0.31 mm. broad by 0.25 to 0.61 mm. long, averaging 0.19 by 0.42 mm.

Aecia tongue-shaped, few, usually clustered, fragile, 1.1 to 2.0 mm. high by 0.7 to 1.3 mm. long, averaging 1.4 by 0.8 mm.; peridial cells ovoid to ellipsoid, sometimes angular in face view, 19 to 30 by 39 to 66 μ averaging 30 by 50 μ, slightly overlapping, with walls 3 to 6 μ thick, the inner closely and finely verrucose with more or less deciduous papillae, 0.2 to 0.9 μ thick and 2.5 to 4.0 μ long; aeciospores, ovoid to ellipsoid, 19 to 23 by 30 to 36 μ, averaging 20 by 32 μ, walls colorless, 1.8 to 4 μ averaging 2.8 μ in thickness, closely verrucose with somewhat deciduous tubercles, 0.7 to 1.6 μ thick, and 1.0 to 2.3 μ long.

Peridermium terebinthinaceae has been collected on the following species of pine:

On *Pinus echinata* in Alabama, Georgia, North Carolina, and South Carolina.

On *Pinus taeda* in Alabama.

A form which may be this species has been collected on *Pinus pungens* Michx. f. in Georgia, and on *Pinus virginiana* Mill, in North Carolina.

The type of the species is F. P. *20994*, collected by Hedgcock on *Pinus echinata* at Auburn, Ala., April 23, 1916.

3. **Peridermium helianthi** sp. nov., the aecial form of *Coleosporium helianthi* (Schw.) Arthur

Pycnia amphigenous, few, often solitary, usually very near the aecia, light brownish olive to olive, 0.2 to 0.5 mm. wide by 0.3 to 0.6 mm. long, averaging 0.4 by 0.5 mm.

Aecia flattened at first, often becoming tongue shaped when fully mature, few, usually clustered, 0.8 to 1.8 mm. high by 0.5 to 1.2 mm. long, averaging 1.3 by 0.8 mm., rupturing longitudinally with coarsely toothed edges; peridial cells ovoid to ellipsoid, 13 to 25 by 27 to 43 μ, averaging 19 by 40 μ, with walls 2 to 4 μ thick; aeciospores ovoid to ellipsoid, often pointed at one end, 15 to 20 by 20 to 28 μ, averaging 17 by 23 μ, with walls 1.2 to 2.8 μ thick, rugose with numerous small tubercles 0.6 to 1.2 μ thick, 1 to 2 μ long.

Peridermium helianthi has been collected only on *Pinus virginiana* but it probably will be found later on *Pinus echinata*. It has been collected in Pennsylvania, North Carolina, South Caroilna, Tennessee, West Virginia, and Virginia.

The type of the species is F. P. *22236*, collected by Hedgcock on *Pinus virginiana* near Greenville, S. C., Apr. 29, 1916.

This species is morphologically very similar to *Peridermium inconspicuum* Long, but proof is lacking of the identity of the two species.

4. **Peridermium fragile** sp. nov.

Pycnia amphigenous, single or few in one or two rows, either near to or on opposite sides from the aecia on yellow green to viridine green areas on the needles, dark olive to olivaceous black, 0.4 to 0.5 mm. wide by 0.5 to 0.9 mm. long, averaging 0.4 by 0.6 mm.

Aecia small and inconspicuous, flattened laterally, few, scattering or in groups, 0.4 to 0.5 mm. high by 0.8 to 2 mm. long, averaging 0.4 by 1.3 mm.; peridia rupturing longitudinally with irregularly notched edges; peridial cells slightly overlapping, ovoid to ellipsoid in face view, frequently pointed at both ends, 17 to 25 by 37 to 46 μ, averaging 21 by 41 μ, with walls 4 to 8 μ thick, the inner verrucose with numerous, crowded papillae 1.1 to 1.9 μ thick and 4.1 to 5.6 μ long, averaging 1.4 by 5.0 μ; aeciospores ovoid to ellipsoid, 18 to 22 by 25 to 34 μ, averaging 21 by 31 μ, with walls 2 to 3 μ thick, the outer surface closely verrucose with irregularly arranged rows of more or less deciduous tubercles, 1.8 to 2.4 μ thick, and 1.7 to 3.2 μ long.

Peridermium fragile has been collected on *Pinus palustris* in Florida and Georgia, *Pinus taeda* in Florida, and on *Pinus rigida* in New Jersey.

The type of the species is F. P. *17426*, collected by Hedgcock on *Pinus palustris* at Brooksville, Fla., Mar. 11, 1915.

5. **Peridermium minutum** sp. nov.

Pycnia solitary or few, or sometimes lacking, tawny to buckthorn brown, 0.2 to 0.4 mm. wide by 0.3 to 0.5 mm. long, averaging 0.3 by 0.5 mm.

Aecia scattered, usually in a single row on the outer side of the leaves, low and inconspicuous, flattened laterally, 0.3 to 0.7 mm. broad by 0.5 to 1.2 mm. long by 0.3 to 0.5 mm. high, averaging 0.5 by 0.7 by 0.4 mm.; peridia very delicate, rupturing longitudinally with finely fimbriated edges which recurve on maturity; peridial cells ovoid, ellipsoid, or rhomboid in face view overlapping but very little, if at all, 18 to 28 by 35 to 70 μ, averaging 21 by 48 μ, with walls 2 to 4 μ thick, the inner finely verrucose with papillae; aeciospores ovoid to ellipsoid to cylindric, sometimes pointed at one end, 14 to 18 by 26 to 38 μ, averaging 15 by 33 μ, with colorless walls 2 to 4 μ thick, the outer verrucose with blunt tubercles 0.8 to 1.4 μ in diameter, 2.7 to 3.4 μ long.

Peridermium minutum has been collected on *Pinus glabra* Walt., and *Pinus taeda* only in Florida.

The type specimen is F. P. *20768*, collected by Hedgcock on *Pinus glabra* near Gainesville, Fla., Mar. 15, 1916.

In the study of various species of *Peridermium* it is found that the pycnia possess good diagnostic characters, not heretofore recognized, and a key to the species known in the eastern United States is in process of preparation in which these with other characters will be used.

It is also found that the peridial cells vary greatly in different parts of the same peridium. Even when cells from the sides and base of the peridium are twice as long as they are wide, the cells at and near the top are only about half as large, with width and length about equal and with walls much thickened. Since some of the basal cells can practically always be found it seems better to base the measurements on them alone.

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METHODS FOR SATISFACTORY FIELD WORK IN THE GENUS RUSSULA

Gertrude S. Burlingham

There are undoubtedly many unreported and undescribed species of *Russula* in the United States. While it is true that the color variations in the same species and the absence of striking characteristics make the identification more difficult than in some genera, the proper study of the species in the field will overcome this difficulty to a large extent. When one is collecting in a rich field, there is always a temptation to sacrifice the quality of the work to the quantity of material taken. But one should remember that five collections of *Russula* with complete field notes are of more value than any number of specimens without full descriptions.

The first essential in collecting is to keep each collection separate. One method is to put each collection in a paper bag of proper size; another, used by the Boston Mycological Club, consists in wrapping the specimens in waxed paper. Each number should be acompanied by a statement of the locality, date, habitat and habits of growth. When possible it is desirable to obtain subsequent collections from the same place so as to accumulate data as to the season of growth, and any variations in color, size, or habit.

The most important fact to be learned in the field is the character of the *taste*. Both young and mature mushrooms should be tasted. I have found it preferable to taste the pileus rather than the stipe, since when the context is only slightly acrid the taste is more pronounced in the pileus. While it is advisable to taste cautiously at first lest the context prove to be very acrid, one should chew enough to determine beyond question whether the taste is acrid, mild, astringent, bitter, or in any way disagreeable.

While examining the context one should also observe whether the broken flesh changes color. This change is not always rapid.

Sometimes it requires two minutes. If the color then persisted, there would be no special need to watch the changes occur, but in several cases a secondary change occurs which obscures the first discoloration. Prof. H. C. Beardslee, of Asheville School, Asheville, N. C., seems to have been the first one to publish any record of an intermediate change to red in *Russulae* outside of the group to which *Russula nigricans* (Bull.) Fr. belongs. In Mycologia 6:91. 1914 he described *R. rubescens,* which differs from *Russula obscura* Rom. in that the wounds become *red* and then gray or black. In the summer of 1916 I determined to look for intermediate color changes in the flesh of all *Russulae.* I found that specimens exactly like what I had formerly referred to *R. obscura* Rom. showed within two minutes after the flesh had been broken a change to peach-red, but that after about five minutes the wounds had become gray. Prof. Beardslee says in regard to specimens of these which I sent him: "They seem to be the same as my *R. rubescens.*" Miss Ann Hibbard, a member of the Boston Mycological Club who spent part of the summer collecting with me, observed the same change to red and then to gray in the broken flesh of a yellow *Russula* conforming in all other respects to *R. flava* Lindbl. The question has naturally arisen, does the flesh of *R. flava* become red, then gray, and I am awaiting an answer to this question from Prof. Romell before pronouncing this a new species. In October Miss Hibbard wrote me from Boston: "There were two more *R. rubescens* at the club exhibition yesterday which were called *R. obscura,* but the stems turned red when I scratched them." Since in other characteristics *R. rubescens* often resembles *R. obscura,* it is mostly impossible to tell whether herbarium material which has been identified as *R. obscura* is this species or *R. rubescens.* Enough has been said to show the importance of the most careful observations regarding the change of color in the broken flesh.

The color of the lamellae in both young and mature specimens should be ascertained, as in some species the color of young lamellae is yellow while in others it is white at first, becoming yellow with maturity. The arrangement of the lamellae affords a permanent characteristic which can be used in classification,

but this can be seen much plainer in the fresh specimen than in the dried state. In some all the lamellae reach the stipe and are simple; in others shorter lamellae are promiscuously scattered among the long ones; in others the short and the long lamellae are systematically arranged. Sometimes lamellae fork near the stipe only, and sometimes they fork once or twice midway to the margin. When the time at one's disposal is short these characteristics may be left to observe in the dried state if the mushrooms are properly dried.

It is, of course, necessary to describe the color of the pileus while the mushrooms are fresh. Not only may the color change during one night after they have been collected, but the color of the dried specimens is often very different from that of fresh ones. Water-color sketches of *Russulae* have great value in expressing the color. One who is collecting fleshy fungi should follow some standard color nomenclature in describing the color. While the color of some species varies through a wide range, there is generally a certain key note of color, as it were, throughout the variation, or certain limitations in variation from which one learns in time to recognize the species. Again there is some other constant characteristic which distinguishes a species in spite of the color variation, as the odor and sordid discoloration of *R. atropurpurea* Pk., or the slight odor and soapy or sticky feeling of the stipe of *R. Mariae* Pk. While studying the color of the pileus one should determine to what extent the cuticle can be peeled off, and a specimen showing the result of this attempt should be included in the collection. Whether the surface is viscid or not is important and can be best observed in the field. The glabrous, pruinose, tomentose, or areolate character of the surface may be permanent, or the surface may change with age or with drying, so that it is advisable to observe the surface of the young and mature specimens in the fresh state.

Of as great importance as the taste and the changing color of the context is the spore color. Sometimes it is difficult to obtain a spore print after specimens have been brought in, and in order to be sure of a satisfactory print, it is a good plan to place a mature pileus on a piece of clear white paper when the plants are

put in the bag in the field. By the time one is ready to study the specimen at home a good print will probably have formed. To be satisfactory, a thick layer of spores should have fallen and the color should always be described from such a layer, as otherwise ochraceous spores may seem pale when only a few have fallen. If only a scattering of spores can be obtained, one may scrape some up with the point of a knife and rub them off in mass on the paper. The spore print should then be folded and either pinned to the description or placed in a small envelope bearing the collection number. Before the print has been kept very long the color should be named according to some standard of color nomenclature, since the spore color may change in time, although if a fixative has not been used there is less danger of this.

There are some general suggestions which may be given. Not only is it important to keep collections in the field distinct, but they must not be mixed during the drying process. They should be tagged with the identification number before placing on the drying screen. As soon as they are thoroughly dried each collection should be wrapped or boxed. I have found that specimens properly dried and taken care of in this manner keep perfectly without the addition of naphthalene. In any case it is preferable not to add the naphthalene until after the specimens have been identified, as it obscures any natural odor which the plants may have. In regard to odor, one should examine the mushrooms in the field, when drying, and after they are dried to detect any characteristic odor.

It is a mistake to assume upon a glance in the field that one group of *Russula* is the same as another taken in some other place or at another time and to limit the description of it to "the same as No. x," since one may be mild, the other acrid; one may have white spores, the other yellow spores; one may have persistently white flesh, the other flesh changing from red to gray or merely to gray. Neither is it a good plan to make a composite description of a lot of fresh mushrooms assuming them to be the same. Each collection should have its own description and if all the descriptions agree in the essential points and the fresh mushrooms

of the different collections as well as the dried ones also agree, then one can arrange a complete description of the species from the descriptions of the various collections taken either the same day, or the same year, or even in different years.

To summarize, each collection of *Russula,* to be of value, should include a number of specimens, where possible, showing a gradation from young to mature forms and any variations in color or size, one which shows to what extent the cuticle is separable, and a lengthwise section. Accompanying the specimens should be a spore print, and a description containing the points outlined above. To these a water-color sketch would be a valuable addition.

Many of the species of *Russula* are edible and occur in some abundance through July and August and the early part of September. For the benefit of any who may wish to attempt to identify species of *Russula* which they may find, I append a short bibliography of American literature on the genus.

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A NEW LEAF-SPOT DISEASE OF POLYGONUM PERSICARIA

P. J. O'Gara

(With Plate 10)

In July of 1914 and August of 1916, Mr. W. W. Jones, botanist in the department of agricultural investigations, American Smelting & Refining Company, made collections of *Polygonum persicaria* L. showing an apparently new leaf-spot. An examination of the literature indicates that this leaf-spot disease has not been previously noted and that the organism is an undescribed species of *Septoria* quite different from the species of *Septoria* described as occurring upon Polygonum or related genera. From field observations it would seem that this type of leaf-spot is rather rare, only two small collections having been made as noted above. The description of the species is as follows:

Septoria persicariae sp. nov.

Maculis amphigenis subcircularibus, 1–8 mm. diam., sparsis v. saepe confluentibus, rubiginoso-brunneis dein centro griseo-brunneis v. griseis, anguste purpureo v. violaceo-limbatis; *pycnidiis* amphigenis, parcis v. numerosis, sparsis v. aggregatis, immersis, membranaceis, brunneis v. atro-brunneis, globosis 50–120 μ diam., osteolo depressis v. parvulo pertusis; *sporulis* hyalinis filiformibus utrinque obtusis v. attenuatis v. saepe uno apice latoribus altero gradatim attenuatis (sub-clavulatis), rectis, curvis v. saepe flexuosis, continuis v. indistincte pluriseptatis, saepe minute guttulatis, 17–60 $\times$ 1–3 μ, cirrose expulsis; basidiis non vivis.

Hab. in foliis vivis *Polygoni persicariae,* Salt Lake Valley, Utah, Amer. Bor. (Wyatt W. Jones).

Department of Agricultural Investigations,
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Salt Lake City, Utah

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—II

Tyôzaburô Tanaka

Phytophthora Allii K. Sawada sp. nov. in Nôji Shikenjô Tokubetsu Hôkoku (Special Report Agric. Exper. Station), Taiwan (Formosa), No. 11, p. 59–60, pl. 1–2. T. 4, iii, Mar. 1915.

Forming a cottony white mycelial mass on diseased portions of leaves of *Allium fistulosum*. Hyphae filiform, hyaline, thin-walled, with granular contents, continuous when young but always septate when old, much branched, 3–8 μ across, penetrating the cell walls of the host tissues. Haustoria not observed. Conidiophores appear through stomata of the host or sometimes break through the epidermal tissue, mostly accompanied by hyphae; conidiophores filiform, fine, single or branching pseudo-dichotomously or rather irregularly ramose, 140–480 $\times$ 4–6 μ; conidia terminal, globular, ovoid, obovoid or lemon-shaped, hyaline, apically mamillate with a hemispherical papillum 5–10 μ high, 40–74 $\times$ 30–50 μ, averaging 49.4 $\times$ 36.5 μ, with or without a thickened septum at the base; falling off not rarely with a portion of persistent conidiophore at the end, producing 15–60 zoospores or germinating with germ tube.

Oogonia formations were observed in cultures on media made of bean agar-agar, and lima bean agar-agar. Oogonia spherical, thin-walled, diam. 17–26 μ (average 20.7 μ), containing one oospore; oospores spherical, colorless or pale-honey-yellow, diam. 14–23 μ (averaging 16.9 μ), walls 0.5–1.5 μ thick. Antheridia surrounding tightly the stalk of oogonia then becoming attached close to the wall of oogonia at the lower portion not far from the juncture of the stalk, usually round to obovoid, 8–18 $\times$ 10–14 μ.

Parasitic on the leaves and flower stalks of *Allium fistulosum*.

Type locality: Taihoku-chô Chônaiho-shô, Taiwan (Formosa), collected by K. Sawada, Feb. 17, 1913 and July 3, 1913.

Illustrations: 45 black and white lithographic figures showing detailed structure of the fungus.

An attempt to inoculate the ordinary onion (*Allium Cepa*) with this fungus was not successful, so it seems that the infection is

limited to the Japanese welsh onion (*Allium fistulosum*); the only plant susceptible to the disease in inoculation tests was *Epiphyllum truncatum* (*Cactaceae*). The disease is not at present widely distributed and the injury not very serious. It is desirable to eradicate it before it spreads to other localities.

The paper gives a review of the genus *Phytophthora* and allied genera; the following species are discussed:

Phytophthora cactorum (C. et L.) Schroet., *P. cactorum* (C. et L.) Schroet. var. *Arecae* Colem, *P. colocasiae* Rac., *P. faberi* Maubl., *P. infestans* (Mont.) de Bary, *P. nicotianae* Breda de Haan, *P. parasitica* Dast, *P. Phaseoli* Thaxt., *P. Syringae* Kleb., *P. Thalictri* Wils. et Davis, *Kawakamia Cyperi* (Miy. et Ideta) Miyabe, *Pythiacystis citrophthora* Smith.

PHYTOPHTHORA MELONGENAE K. Sawada sp. nov. in Nôji Shikenjô Tokubetsu Hôkoku (Special Report Agric. Exper. Station), Taiwan (Formosa) No. 11, p. 77–79, pl. 3. T. 4, iii, Mar. 1915.

Hyphae intercellular in the host tissue or freely penetrating the cell wall, much branched, not septate in juvenile stage, but septate when mature; aerial hyphae mostly not branching, usually attaining a considerable length, nearly uniform in diameter, the base always irregularly twisted, swelled or short-branched, and very characteristic; diam. of hyphae 4–8 μ; haustoria none. Conidiophores hardly distinguishable from aerial hyphae, filiform, delicate, very much elongated, the shortest measuring 80 μ in length, 3–5 μ across; conidia spherical, broad-oval or oval, 24–72 $\times$ 20–48 μ, average 42.4 $\times$ 33.9 μ, with apical hemispherical papillae 3–5 μ high, producing several to 40 zoospores; zoospores ovoid or ellipsoid, 10–11 $\times$ 8 μ, with 2 cilia; chlamydospores yellowish-brown, spherical, 25–42 μ in diam.; oogonia formed in cultures on bean agar-agar medium, spherical, 18–23 $\times$ 20–24 μ, containing one oospore; oospore spherical, walls 2 μ thick, colorless to very pale yellowish-brown, diameter 17–21 μ. Antheridia not formed on the same hyphae that bear the oogonia but on the end of other hyphae, surrounding tightly the oogonial stalk and attached to the wall of oogonia at the juncture with the stalk, oblate spheroidal or nearly spherical, 10–14 $\times$ 12–16 μ.

Parasitic on the fruit of *Solanum Melongena* (Egg plant).

Type locality: Taihoku-chô, Chônaiho-shô, Taiwan (Formosa), June 18, 1914, July 10, 1914, and Sept. 6, 1914.

Illustrations: 24 black and white lithographic figures showing detailed structure of fungus.

Not only the Formosan white egg plant but all other Japanese varieties are susceptible to this disease and in one case 60 to 70 per cent. of the crop was lost. Inoculation tests proved that other solanaceous plants are susceptible and such plants as tobacco, tomato and even Irish potato were attacked. Among plants belonging to other families, figs, *Areca Catechu*, and *Hibiscus esculentum* were counted as susceptible hosts, and in a lesser degree *Epiphyllum truncatum* and *Ricinus communis.*

ZUKALIA NANTOENSIS K. Sawada sp. nov. in Nôji Shikenjô Tokubetsu Hôkoku (Special Report Agric. Exper. Station), Taiwan (Formosa), No. 11, p. 123, pl. 4, figs. 14–18. T. 4, iii, Mar. 1915.

Epiphyllous, sometimes also hypophyllous, lichenous, spreading over an area 2–5 mm. across, tightly coalescent; hyphae fuliginous, thick-walled, 8 μ across, septate and sparsely furnished with hyphopodia, oblong bodies with rounded end usually on a stalk 18–25 μ long. Pycnidia and perithecia grow on the mycelial layer, both orbicular black bodies, mostly sessile, sometimes on stalks 18–25 μ long; pycnidia 63–95 μ, containing numerous pycnospores; pycnospores pale-brown, ellipsoid to oblong, glabrous, unicellate, bi-nucleate, $6–8 \times 3–4\ \mu$; perithecia 132–180 μ in diameter, with numerous asci; asci oblong-clavate, ovoid-oblong, with short stipules, hyaline, $33–49 \times 10–12\ \mu$, containing 8 spores; ascospores oblong to short clavate, septate at the middle, colorless, blunt or obtuse at both ends, $9–13 \times 3.5–5\ \mu$.

On leaves of *Thea sinensis.*

Type localities: Nantô-chô, Gyochi, Taiwan (Formosa), Oct. 30, 1907, Suzuki, Rikiji; Nantô-chô Shinjô, Taiwan (Formosa), Oct. 17, 1913, Fujikuro, Yosaburô.

This fungus causes the Susu-byô (Sooty mould disease) of tea in Formosa, mostly occurring with *Zukalia Theae* K. Sawada, *Scorias capitata* K. Sawada, and *Capnodium Footii* Berk. et Desm.

MASSARIA PHORCIOIDES I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical Report, Imperial Sericultural Experiment Station), Tôkyô, Japan, 1^5: 316, pl. 16, figs. 4–5. T. 5, xii, Dec. 1916.

Perithecia scattered over the twigs forming black spots, the diseased cortex of the twig being very easily separated from the wood. Perithecia hypoepidermal, opening with ostiola, consisting of pseudo-parenchymatous tissue, black, spherical or ellipsoid, 250–300 μ in diameter and 200–250 μ in height, containing few asci; asci clavate to elliptic, 110–140 $\times$ 35–42 μ, short stipitate, with 8 biseriate spores, paraphysate; ascospores fusiform, dark-yellowish-brown, 1-septate and 3–5 nucleate at first, then 4, rarely 3–5 septate, constricted only at the middle septum first formed, 45–52 $\times$ 19–22 μ, covered with a gelatinous envelope; paraphyses filiform, stout, with granular contents.

On twigs of *Morus alba*, possibly parasitic (common).

Type localities: Gifu-ken (prefecture) Kaidzu-gun Kaisai-mura, Mar. 1909, I. Miyake; Fukui-ken (prefecture) Tsuruga, Mar. 1909, K. Hara; Fukushima-ken (prefecture) Fukushima-shi and Yamagata-ken (pref.) Yamagata-shi, Mar. 1915, I. Miyake; Akita-ken (pref.) Akita-shi, and Ôtate-chô, Iwate-ken (pref.) Fukuoka-chô, and Kyôto-fu (pref.) Ayabe-chô, Apr., 1915, I. Miyake.

Distribution: China, Japan.

Illustrations: 2 black and white lithographic figures showing perithecium and ascospores.

At the side close to the perithecia, a conidial form usually occurs which consists of rosy-colored, caespitose conidiophores and spherical or short elliptical hyaline conidia. The relation between this form and the ascogenous form here described has not yet been studied. The characteristic perithecial position of this fungus can be seen with the naked eye if we examine carefully the blackened discoidal surface of the diseased spot on which a highly darkened spot at the central part is to be observed which represents the perithecial body underlying the epidermal tissue.

MASSARIA MORI, I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical Report, Imperial Sericultural Experiment Station), Tôkyô, Japan, 1^5: 319, pl. 17, figs. 12, 13, 14. T. 5, xii, Dec. 1916. (Japanese.)

Perithecia covered by epidermis which is pierced by shortly projecting ostiola, scattered or 2–3 together, mostly surrounded by black hyphal substance pseudo-parenchymatous in appearance, globoid or ellipsoid, 400–600 μ in diam.; perithecial walls consist-

ascospores biseriate, nearly fusoid, somewhat acute but inconsiderably thickened at one end, 3-septate, constricted at the middle septum first formed but not at others, first nucleate with few large hyaline globules, then coarsely guttulate with yellowish-brown homogeneous contents, and finally opaque with blackish-brown fine granules, $55–70 \times 18–23\,\mu$, covered by a gelatinous envelope; paraphyses forked, $2.5–3.0\,\mu$ across, colorless and far longer than the asci.

On twigs of *Morus alba.*

Type localities: Akita-ken (prefecture) Yuzawa-chô, Mar., 1915, I. Miyake; Kyôtô-fu (pref.) Ayabe-chô, Apr., 1915, I. Miyake.

Illustrations: 3 black and white lithographic figures showing detailed structure.

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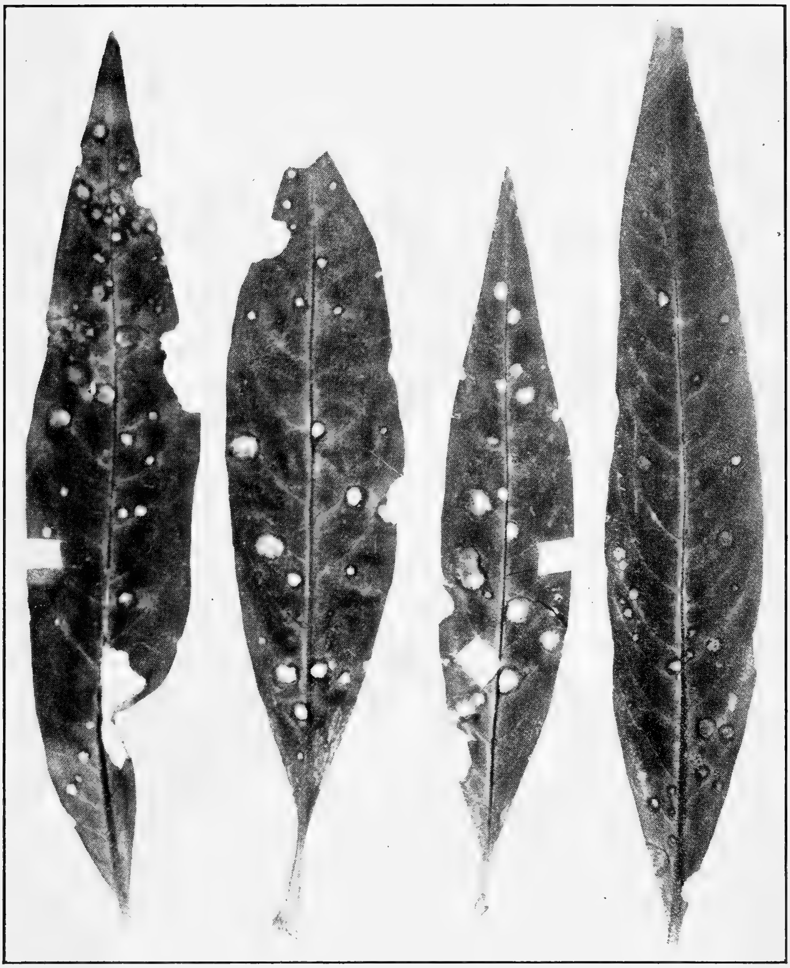

Photograph of type specimens of leaves of *Polygonum persicaria* L. infected with *Septoria persicariae* O'Gara. From the collection of Wyatt W. Jones, Salt Lake Valley, Utah, August 23, 1916

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THREE DOLLARS A YEAR

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ILLUSTRATIONS OF FUNGI

MYCOLOGIA

VOL. IX SEPTEMBER, 1917 NO. 5

ILLUSTRATIONS OF FUNGI—XXVII

WILLIAM A. MURRILL

The accompanying plate shows several species of white-spored gill-fungi painted by Miss Eaton in their natural colors from specimens collected in or near New York City.

Chanterel Chantarellus (L.) Murrill

Cantharellus cibarius Fries

EDIBLE CHANTEREL

Plate 11. Figure 1. × 1

Pileus fleshy, firm, turbinate, nearly plane, sometimes depressed, gregarious, cespitose at times, 3–8 cm. broad; surface glabrous, luteous, rarely paler yellow, margin involute to expanded, undulate; context white, nutty or slightly acrid, edible; lamellae thick, narrow, distant, decurrent, forked or irregularly anastomosing, luteous, or sometimes much paler; spores ellipsoid, somewhat irregular, smooth, pale-ochraceous, 8–10 × 4–5 μ; stipe attenuate below, glabrous, concolorous or paler, solid, 2.5–5 cm. long, 6–12 mm. thick.

Common throughout temperate regions in deciduous or coniferous woods, especially in dense evergreen thickets, appearing in mid-summer. It is egg-yellow all over, and has peculiar narrow, blunt, decurrent lamellae. This species has long held a high reputation for edibility, and the only poisonous species with which it may be easily confused is *Chanterel aurantiacus*. It should be

[MYCOLOGIA for July (9: 185–256) was issued July 30, 1917.]

stewed for nearly an hour and seasoned with butter or meat gravy. It is an excellent addition, also, to hashes, meat stews, and omelets.

Clitocybe virens (Scop.) Sacc.

Clitocybe odora (Bull.) Quél.

FRAGRANT CLITOCYBE

Plate 11. Figure 2. × 1

Pileus fleshy, tough, convex, becoming plane or nearly so, obtuse or subumbonate, scattered or subgregarious, 4–7 cm. broad; surface glabrous, moist in wet weather, green or dingy-green, fading with age or on drying, margin even, regular or sometimes wavy; context whitish, the odor pleasant like anise; lamellae thin, crowded, adnate or slightly decurrent, white or becoming pallid; spores 6–8 × 4–5 μ; stipe equal or slightly thickened at the base, stuffed or hollow, elastic, glabrous, whitish or greenish, 2.5–5 cm. long, 4–8 mm. thick.

A woodland species of unusual and beautiful colors found in the eastern United States from Maine to North Carolina and west to Michigan. Peck called it *Clitocybe anisaria* because of its agreeable odor. This species has appeared regularly each year among the leaves in a small grove of young birch trees at the edge of the Hemlock Grove in the New York Botanical Garden.

Prunulus purus (Pers.) Murrill

Mycena pura (Pers.) Quél.

PURE PRUNULUS

Plate 11. Figure 3. × 1

Pileus fleshy, thin, campanulate or convex to expanded, obtusely umbonate when young, 2–5 cm. broad; surface smooth, glabrous, of uniform color, varying from rose to rose-purple, violet, or lilac, margin striate, upturned with age; lamellae rather broad, adnate to sinuate, sometimes wavy and crenate on the edges, venose-connected, varying from white to shades of rose or violet, sometimes white on the edges; spores oblong, hyaline, 7–9 × 3–3.5 μ; cystidia subcylindric, 30–40 × 13–15 μ; stipe firm, smooth, subglabrous, concolorous, hollow, somewhat villose at the base, 5–8 cm. long, 2–4 mm. thick.

This beautiful species is common on the ground in woods throughout temperate North America, occurring in various forms and colors. It was figured and described in Mycologia 7: 117. *pl. 158, f. 3,* but is included here because the drawing gives a better idea of the plant. Another species, *Prunulus denticulatus,* which is found at times in northern New York, is closely related and similar in color, but has a livid-purple cap and blackish-violet gills.

Gymnopus dryophilus (Bull.) Murrill

Collybia dryophila (Bull.) Quél.

OAK-LOVING GYMNOPUS

Plate 11. Figure 4. × 1

Pileus thin, convex or nearly plane, sometimes with the margin elevated, irregular, obtuse, commonly gregarious, 2.5–5 cm. broad; surface glabrous, varying in color, commonly some shade of bay-red or tan-color; context white, edible; lamellae narrow, crowded, adnexed or almost free, white or whitish, rarely yellowish; spores ellipsoid, 6–7.5 × 3–4 μ; stipe glabrous, yellowish or rufescent, commonly similar in color to the pileus, equal or sometimes thickened at the base, cartilaginous, hollow, 2.5–5 cm. long, 2–4 mm. thick.

This species has been discussed twice before in this series (Mycologia 3: 101 and 4: 164), but in neither case was the true *G. dryopohilus* as at present limited correctly figured. It occurs commonly in woods and groves throughout temperate North America and is often used for food, although there are several closely related species that have not been sufficiently tested for their poisonous or edible qualities.

Cortinellus rutilans (Schaeff.) P. Karst.

Tricholoma rutilans (Schaeff.) Quél.

REDDISH CORTINELLUS

Plate 11. Figure 5. × 1

Pileus fleshy, campanulate, becoming plane, 5–10 cm. broad; surface dry, at first covered with a dark-red or purplish tomentum,

then somewhat squamulose, sometimes yellowish with age, margin thin, at first involute; context yellow, taste mild, odor none; lamellae crowded, rounded, white to yellow, thickened and more or less villose and serrulate on the edges; spores globose or subglobose, 6–7.5 × 6–6.5 μ; stipe somewhat hollow, nearly equal or slightly thickened or bulbous at the base, pale-yellow, variegated with red or purplish, floccose squamules, 5–10 cm. long, 10–16 mm. thick.

A large and conspicuously colored species found on or about old stumps in coniferous or mixed woods from Maine to North Carolina and west to Colorado and Washington. It should be readily recognized by the colors of its upper and lower surfaces and the serrulate, villose edges of its gills.

Gymnopus strictipes (Peck) Murrill

Collybia strictipes Peck

STRAIGHT-STEMMED GYMNOPUS

Plate 11. Figure 6. × 1

Pileus thin, broadly convex to nearly plane, cespitose, 2.5–6 cm. broad; surface glabrous, sometimes slightly rugose on the disk, moist but scarcely hygrophanous, whitish or pale-yellow, paler when dry, often more deeply colored on the disk; lamellae thin, close, adnexed or almost free, white; spores ovoid or subellipsoid, pointed or subacuminate at one end, 6–7.5 × 4 μ; stipe glabrous, slightly mealy or pruinose at the apex, white, often with a dense, white, mycelioid tomentum at the base, equal, straight, hollow, 3–6 cm. long, 4–6 mm. thick.

This species occurs in clusters among dead leaves or on decayed wood in woods from New England to the District of Columbia and west to Ohio. The stipe is quite characteristic, being very erect and regular in shape and somewhat translucent in appearance.

NEW YORK BOTANICAL GARDEN.

AN UNDESCRIBED TIMBER DECAY OF PITCH PINE[1]

L. O. Overholts

(With Plates 12 and 13)

In the vicinity of State College, Pennsylvania, the pitch pines (*Pinus rigida*) are dying rather rapidly, especially in the more open woodlands. Most of these trees are fairly mature and the cause of their death has not been satisfactorily determined. The effects of the pine bark borers are very evident just beneath the bark of the dead trees, but whether or not they are responsible for the injury cannot be stated at present. Within a few months after the trees die, and while they are yet standing, they often become heavily infected with the "blue stain" fungus (*Ceratostomella pilifera*) as evidenced by the extensive bluing of the sap wood. After the dead trees fall they are subject to the attacks of several of the wood-destroying fungi. The most important of these are *Polyporus abietinus* (Dicks.) Fries and *Polyporus amorphus* Fries. In fact, the sporophores of these two species are the only ones that have ever been found on timber decayed in the manner described in this article. The decay produced by *P. abietinus* is well known and abundant on both pine and hemlock wood in this vicinity. It is entirely unlike the decay described here and cannot be considered in this connection. The decay produced by *P. amorphus* has not been studied in pure culture inoculations but the evidence at hand is such as to leave no doubt that the effects here described are due to the mycelium of that fungus.

The Fungus and Its Identification

Polyporus amorphus has been considered to be quite rare in this country. Specimens submitted to the New York Botanical

1 Read before the Botanical Society of America at the New York meeting, December, 1916. Contribution from the Department of Botany, The Pennsylvania State College, No. 11.

Garden within the past year were reported as the first to be received from America. Through the kindness of Dr. Murrill I have been able to compare my specimens with specimens of European origin communicated by Bresadola, and the two are identical. Mr. C. G. Lloyd of Cincinnati, Ohio, has reported the species from different localities in this country. More recently Long[2] has reported that a fungus identified as *P. amorphus* was found rotting slash of the short-leaf pine in Arkansas. At the writer's request specimens from the Arkansas collections were sent for study. No evidence was found that the fungus is not the species in question, but the sporophores are not well developed and a positive determination of Mr. Long's specimens is impossible at this time. Hitherto it had appeared doubtful if the species had so much of a southern range. Present indications are that when well studied its range will be mostly confined to southern Canada, New England, and the states bordering on the Canadian line.

In the vicinity of State College the species is not rare. Probably its small size and resemblance to related species have often caused it to be overlooked or wrongly determined. In the herbarium of the Pennsylvania State College there are at least six different collections of the species and the writer's herbarium contains half as many more. It is probably a safe statement that at present as many collections are known from Pennsylvania as from all other parts of the United States combined. From this it might appear that the species can be of very little economic importance as a producer of timber decay, but it must be borne in mind that very few localities in the United States have been thoroughly explored in a mycological way. Indeed, if the prevalence of the fungus in the vicinity of State College can be regarded as a criterion of its occurrence in other localities of the same latitude it may even happen that the species is one of the more common ones where different species of pines are native. The fact that the fungus is not confined to the wood of pitch pine adds interest in this connection. One collection has been made from the wood of white pine (*Pinus Strobus*), one

[2] Long, W. H. Investigations of the rotting of slash in Arkansas (U. S. Dept. Agr. Bul. 496, p. 8, 1917).

from an old stump of table mountain pine (*Pinus pungens*), and one from a log of hemlock (*Tsuga canadensis*). These last three collections were among the first to be made and at that time no special attention was given to the type of decay produced. Consequently, material is yet lacking by means of which a comparison might be made of the characteristics of the decay in the wood of other coniferous species. There is no reason for assuming, however, that any essential difference could be detected.

The sporophores of the fungus are in some respects quite variable, yet they can be distinguished with ease after their characters are once known. When well developed the sporophore is sessile, but often it is extensively effused-reflexed and sometimes resupinate. Where the pine log lies flat on the ground the fungus is apt to spread itself over needles and chips of pine that happen to lie adjacent to the log. The color of the pileus is gray due to the covering of a grayish tomentum arranged in narrow concentric zones. The hymenium varies in color from flesh-color to orange or brick-red. According to European authorities it may at times be white or cream-colored, but such colors have been observed only in old weathered specimens of our plants. It is quite probable, however, that the depth of color developed is more or less dependent on the abundance of light. At times, and especially when growing over chips and needles of pine, an abundant development of rhizomorphs takes place. These are yellow or light orange in color, cylindric in shape and vary up to almost one millimeter in diameter. The fungus may be described, as follows:

POLYPORUS AMORPHUS Fries

Pileus coriaceous, sessile, effused-reflexed, or occasionally resupinate, 0–2 × 1–3 × 0.1–0.3 cm.; surface whitish or cinereous, villose-pubescent or tomentose, marked with narrow concentric zones; context white, 1–2 mm. thick; tubes less than 2.5 mm. long, the mouths angular, thin walled, flesh-color to orange or brick-red, averaging 2–4 per mm.; spores allantoid, hyaline, 4–5 × 1–2 μ; cystidia none; hyphae not much branched, 3–5 μ.

On wood of pine (*Pinus rigida, P. Strobus,* and *P. pungens*) or running over chips and needles of pine; rarely on wood of other coniferous trees. Probably confined to the northern United States and southern Canada.

Superficially the fungus bears some resemblance to *Polyporus dichrous* Fries, and sometimes the hymenium is perhaps inclined to be somewhat waxy in consistency, but it does not peel off in a thin smooth layer in fresh specimens and the color is usually not the same. Moreover, *P. dichrous* is confined to the wood of deciduous trees. Immature specimens bear some resemblance to certain species of *Merulius* and one such collection was once referred to a species of that genus, but determinations of such immature material are always to be taken with certain reservations until better material is obtained.

Name Used in Designating This Decay

From the standpoint of convenience and simplicity it would be well to have some common name to apply to the decay caused by each of the wood-rotting fungi. Such names should be based on some conspicuous character of the decay. This feature probably can never be carried out in entirety because of the great similarity among the decays produced by several different fungi. For example, decays produced by *Polyporus versicolor* and a number of related species do not differ conspicuously among themselves nor from the decays produced by three or four of the common pileate species of *Stereum*. But the idea should be carried out so far as possible.

Because of the peculiar appearance of the rotted wood it is proposed to designate the decay caused by *Polyporus amorphus* as the "stringy rot" of pitch pine.

Macroscopic Characters of the Decayed Wood

While observations are not complete, the fungus has so far been found attacking only the sapwood of the fallen pines. It has never been found on standing trunks and attempts at locating the mycelium in the sound heart wood have so far failed. Where it attacks the smaller branches in which heart wood has not been formed, it, of course, penetrates entirely through the wood.

As the pine logs lie on the ground one can never judge, even by tapping with a hammer, to what extent the wood is decayed. The outer layers of the sapwood usually form a firm but thin

shell made up of wood that is apparently nearly sound. This is probably because these layers have too low a water content for the growth of the fungus. That this surmise is correct is borne out by the fact that where the thick bark of the pitch pine remains as a protective covering on the trunk the outer layers of sapwood are decayed to a considerable extent. The bark falls off rather readily in the pitch pine, especially if the tree stands for several months after it dies. Consequently, in cases where the decay is well advanced the bark is generally lacking and the more sound shell of sapwood is present.

The sound dried sapwood of *Pinus rigida* is of a very light color and contrasts strongly with the brownish red color of the less extensive heartwood. One of the conspicuous characteristics of the decay is the change in color of the diseased sapwood from the normal light color to a shade that matches exactly the "cinnamon buff" of Ridgway's color manual. Since those decays in which delignification of the woody elements takes place result in a whitening of the diseased wood, it can be conjectured at once that the action in this case is at least in part not one of delignification but one in which cellulose is one of the chief elements dissolved.

The most conspicuous feature of the decay is now to be described. When a mass of the decayed wood is examined and attention directed to a lateral view of a rough radial section one sees very narrow bands of fairly firm wood between which the woody elements have been almost entirely removed. In other words, narrow bands of sounder wood alternate with long narrow cavities, neither band nor cavity with a thickness of more than one millimeter. Into these cavities or furrows project small bits of wood, often triangular in outline. The frequency of their occurrence and their form suggest that they are medullary rays. Under the microscope they are seen to be composed mostly of vertical tracheids bound together by the remains of the ray tracheids. The parenchyma cells of the rays have disappeared and the vertical tracheids are well filled with mycelium and are seen to be in a state verging on collapse.

The alternating elongated cavities and bands of wood are the characteristic marks of the decay and have suggested the name

"stringy rot." As will be brought out later, the bands of wood remaining are the areas of summer wood, which probably because of its compactness is not so easily destroyed. The elongated cavities represent the spring wood that is destroyed long before the summer wood disappears. It is evident that this separation of spring and summer wood results in the formation of concentric rings in the wood. These rings do not coincide entirely with the annual rings but the annual rings are split into their two growth areas, spring and summer wood. Consequently it is often possible to separate blocks of rotted wood into concentric slabs, although the persistence of groups of vertical tracheids bound together by ray tracheids aids in holding these concentric rings together.

In addition to the above characteristics, the rotted wood may be described as soft and watery in texture when found in the woods. It is quite flexible and readily separates into narrow strings or strands when twisted, often giving a rough broom-like appearance. When dry the well rotted wood is brittle and snaps under slight pressure. No concentric or other cracks due to shrinkage are present as are found in some rots (e. g., that caused by *Polyporus sulphureus, P. borealis,* etc.) Neither are sheets of mycelium ever developed in the cavities that appear. In rare cases small strands of mycelium may appear just under the bark or in the very rotten wood. No spots or colored lines of any sort are present in the decayed wood.

Microscopic Characters of The Decayed Wood

The wood of pitch pine is made up of two elements, i. e., vertical tracheids and medullary rays. The vertical tracheids have a single row of bordered pits on the radial walls. Consequently the radial section alone will show these pits in surface view. When the lignin and cellulose tests[3] are applied to the

[3] The lignin test found most serviceable was the phloroglucin test with hydrochloric acid. Free hand sections of the wood were first treated with a two per cent. solution of phloroglucin in 95 per cent. alcohol. This was immediately drained off and a drop of rather strong HCl added. The result was a beautiful red color assumed by all lignified membranes.

The best cellulose test was found to be the reaction with chlor-iodide of zinc solution made up as recommended in Steven's Plant Anatomy. If

sound wood of *Pinus rigida* the vertical tracheids give the reaction for lignin with the exception of the inner surface of the bordered pits. These remain practically uncolored in the center but most of them show a narrow ring of red at the outer margin. In sections showing the structure of the tracheid walls the middle lamella, secondary lamella, and tertiary or inner lamella all give a lignin reaction that varies in intensity in the different parts. Consequently there is little free cellulose in the vertical tracheids. The medullary rays of the sound wood of pitch pine are bordered above and below with one or more series of horizontal ray tracheids with inner walls conspicuously denticulate as is characteristic of the pitch pine group. These give a definite lignin reaction and do not respond to the cellulose test. The ray parenchyma cells, on the other hand, soon develop the characteristic lavender-violet color when treated with chlor-iodide-zinc solution. Consequently they are composed of unmodified cellulose. These reactions of the sound wood serve as a basis of comparison for detecting changes in the wood decayed by the fungus.

When the wood becomes infected with the mycelium of the fungus the medullary rays are first attacked. The ray parenchyma cells disappear rapidly as can be readily seen either in tangential or radial sections of the wood. The cells that still persist in the angles of the rays as seen in tangential section are ray tracheid cells. Their lignified nature enables them to withstand the attacks of the mycelium for a somewhat longer time. Undoubtedly the rot progresses rapidly inward along the line of the medullary rays. In radial section these hyphae can readily be traced within the cavity formerly occupied by the ray cells and are seen to send off frequent branches into and between the vertical tracheids of the spring wood. The intercellular hyphae enter the tracheids either through the bordered pits or apparently by simply dissolving a hole through the wall, as many such irregular holes can be seen and how they could otherwise originate is not plain. As the hyphae pass through the bordered pits these rapidly become disorganized and many different

cellulose is present it becomes a bluish-lavender color in this solution. Usually the reaction is slow in appearing and increases to a maximum intensity in a very few minutes. The sulphuric acid-iodine test was also used but found much less satisfactory.

stages in their dissolution are readily found in radial section. They are represented in plate 13, figure 3. The disintegration takes place in a more or less centrifugal direction but evidence of dissolution in the outer ring of the border is evident before the more central parts are entirely destroyed.

After entering the tracheids, growth takes place in a vertical direction and so the mycelium rapidly reaches hitherto unattacked medullary rays. At such points one to several hyphal branches are given off to the medullary rays or, as seen in plate 13, figure 1, the main hypha may enter the ray and pass through and out on the opposite side, following the same vertical direction as before but in another line of vertical tracheids. In this manner it is not impossible to trace the hyphae for rather long distances in a vertical direction.

In the meantime the rays first attacked have been practically all destroyed. Soon after the ray parenchyma cells disappear the ray tracheids show evidences of disintegration. Their complete dissolution usually occurs about the time the bordered pits in the vertical tracheids of the near vicinity are being disintegrated. In many cases, however, their lateral walls persist much longer and apparently result in binding together a small bundle of tracheids. These bundles may persist even after the spring wood of a given annual ring has been destroyed so that they project into the resulting cavity and are quite conspicuous, as mentioned under the description of the macroscopic appearance of the decayed wood and as shown in plate 12, figure 2 (left).

When a fairly advanced stage of the decay is studied it is seen that the medullary rays have practically entirely disappeared and the vertical tracheids are in a state of collapse. Prior to this time no free cellulose can be detected in these tracheids. In later stages of decay, however, the reaction to the chlor-iodid-zinc solution is distinctly positive and the remains of the tracheid wall as seen in surface view is colored a uniform lavender-violet. This, of course, means that the lignin has been removed from these walls. It probably does not indicate that cellulose destroying enzymes are not present later, else the wood would not eventually be entirely destroyed. On the other hand, it seems justifiable to conclude that the mycelium at practically every stage of

its growth produces both types of enzymes but that in the young mycelium more of the cellulose destroying enzyme is produced while in later stages the lignin destroying enzyme is produced in larger quantities.

Eventually the tracheids in the spring wood are entirely destroyed and long narrow cavities are formed in the space it formerly occupied. The summer wood is attacked before the spring wood is destroyed and it may even be possible that mycelium enters it as early as it does the spring wood. But the more compact structure of the former makes it able to withstand the attacks of the fungus for a much longer time. Even after the spring wood is entirely destroyed the summer wood is quite firm, although it has changed to the cinnamon-buff color and has become quite brittle. Because its destruction is such a long drawn out process it may even be doubted whether in a state of nature it is ever entirely destroyed by this fungus. Longer periods of exposure might result in the entrance of other organisms through which the decay would be hastened and eventually completed.

SUMMARY

Polyporus amorphus cannot yet be said to be a common fungus in this country since only a few collections are known. It is probable, however, that it is more common than these collections would indicate. Indications are that its range will be southern Canada, New England, and the states bordering on the Canadian line.

The fungus causes a characteristic decay of the sapwood of *Pinus rigida,* and has been collected also on wood of *P. Strobus, P. pungens,* and *Tsuga canadensis.*

In external appearance the decayed wood is darker in color than sound wood and is of a cinnamon-buff color (Ridgway). The spring wood is completely decayed long before the summer wood disappears. This results in the formation of concentric cavities alternating with the bands of firmer summer wood, and has suggested the name "stringy rot."

Microscopic examination and microchemical tests establish the fact that the fungus first dissolves out the cellulose of medullary

rays, then the bordered pits. The lignified structures including the ray tracheids and the vertical tracheids are then attacked and eventually (at least in the spring wood) entirely destroyed. Consequently it is believed that cellulose dissolving enzymes are produced in quantity by the younger mycelium, although probably a lignin dissolving enzyme is not entirely absent. In later stages of decay a lignin dissolving enzyme is produced in greater quantities.

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EXPLANATION OF PLATES

PLATE 12

Fig. 1. Sporophores of *Polyporus amorphus* showing its effused-reflexed habit and the concentrically zoned pileus.

Fig. 2. Wood of pitch pine decayed by *Polyporus amorphus.* The elongated cavities alternating with bands of the sounder summer wood are quite conspicuous.

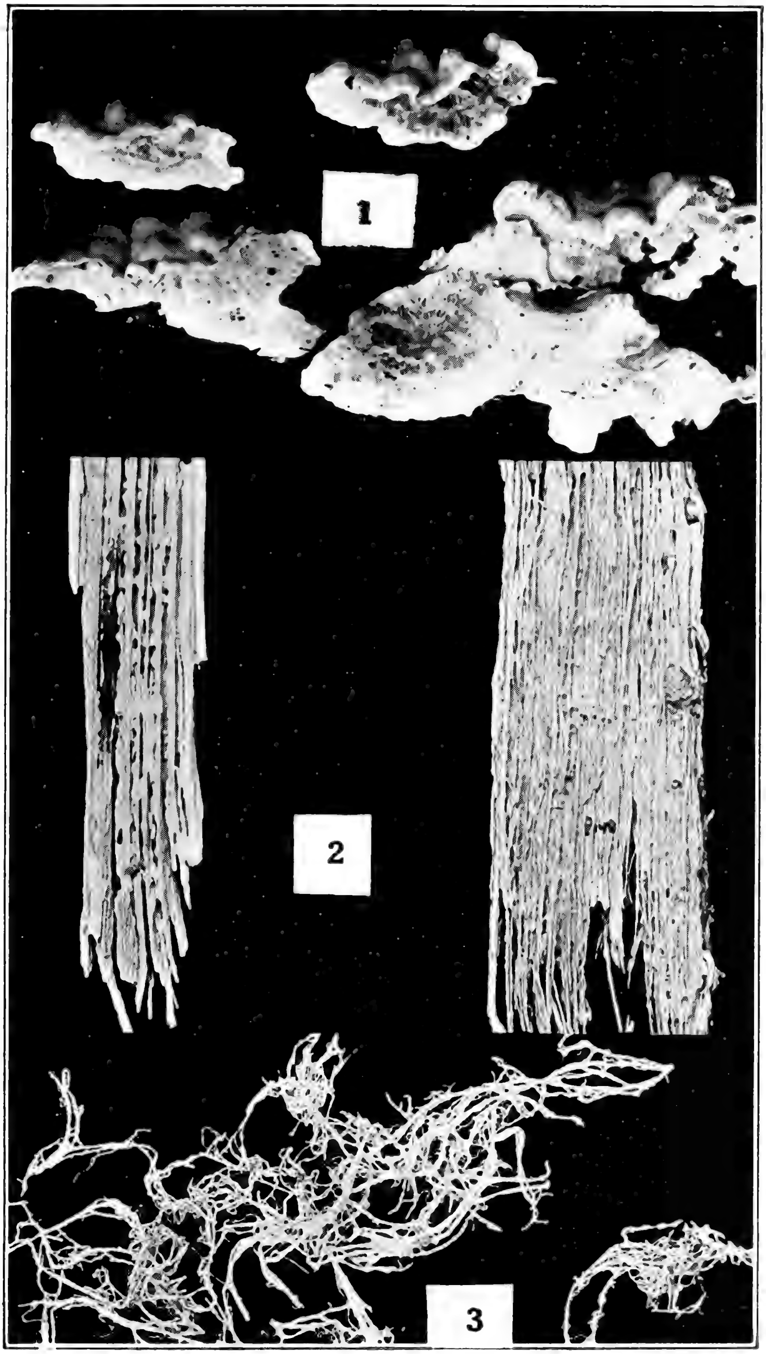
Fig. 3. Rhizomorphs of *Polyporus amorphus.*

PLATE 13

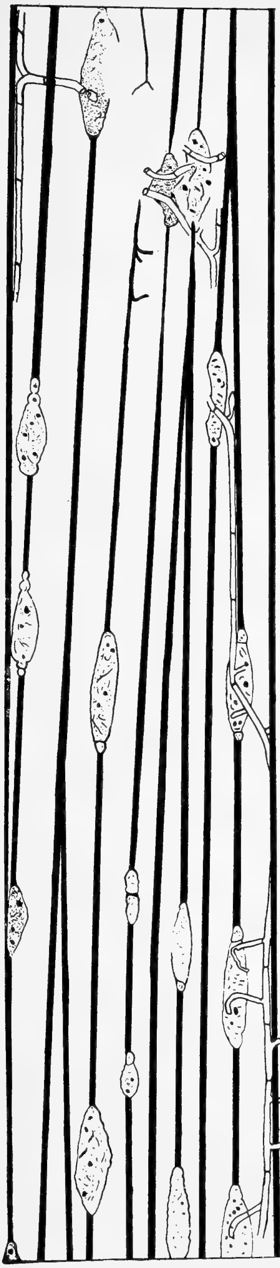
Fig. 1. Camera lucida drawing of a tangential section of pitch pine wood rotted by *Polyporus amorphus.* The parenchyma cells of the medullary rays have entirely disappeared. Ray tracheid cells still persist in the angles of some of the rays. The branching of the hyphae at the rays is conspicuous.

Fig. 2. Camera lucida drawing of a radial section of wood rotted by *Polyporus amorphus.* Various stages in the destruction of the bordered pits are seen at *A–E.* At *F* note remains of a medullary ray.

Fig. 3. Drawing of a radial section of wood rotted by *Polyporus amorphus.* Earlier stage of decay than figure 2. The parenchyma cells have disappeared from between the ray tracheids (R. T.), leaving the cavity *M.* The tracheids still show the characteristic denticulate wall of pitch pines. *P* is a pit in the wall of a ray tracheid. *H,* a large hypha running through the medullary ray.



POLYPORUS AMORPHUS Fries



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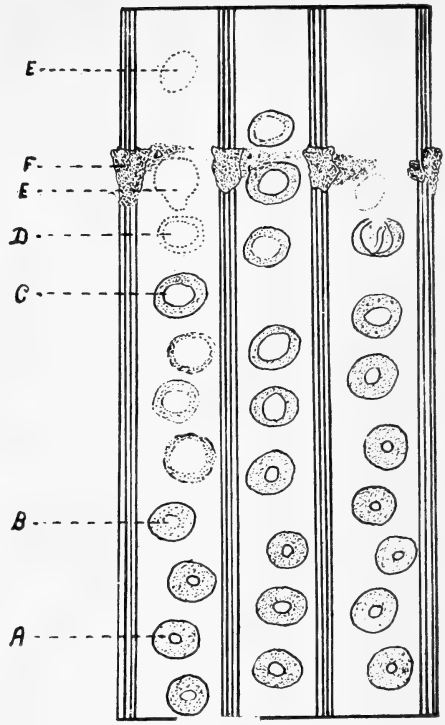

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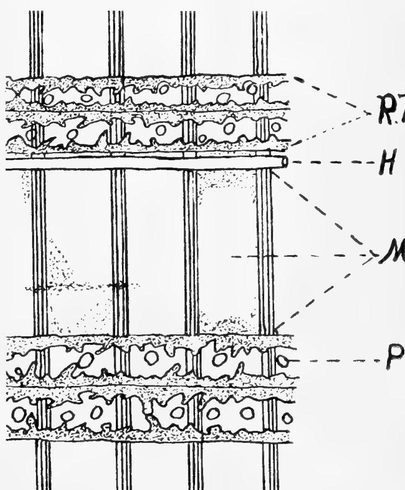

3

POLYPORUS AMORPHUS Fries

NOTES ON NEW OR RARE SPECIES OF GASTEROMYCETES

W. H. Long

For several years the writer has had in his herbarium three species of *Gasteromycetes,* collected in Texas, two of which are undescribed. Lack of time has prevented an earlier discussion of them.

Geasteroides gen. nov.

Peridium double; exoperidium splitting into starlike, reflexed, persistent segments; endoperidium more or less deciduous, fragile, upper half usually splitting into fragments which cling to inner surface of exoperidium when it expands, basal portion of endoperidium persistent and attached to a corky sterile base, mouth single, columella and capillitium present.

Geasteroides texensis sp. nov.

Exoperidium thick, rigid, coriaceous, subhygrometric, outer surface ocher-colored to whitish in old specimens, often with an outer thin layer of arachnoid mycelium and dirt that peels off as the plants mature, 4–10 cm. in diameter when expanded, splitting into 7–10 unequal and strongly recurved segments with incurved tips, segments about one half as long as entire exoperidium, convex above and concave beneath when fully expanded, inner surface of exoperidium dark brown, fissured and cracked when dried; endoperidium seated on a short subligneous stipe which broadens out into a top-shaped, persistent, corky, sterile base, top-shaped base including stipe and gleba 1–3 cm. tall by 1–3 cm. broad, endoperidium whitish to brownish, very fragile, apparently with a poorly defined mouth, upper part of endoperidium breaking away either when the exoperidium opens or soon thereafter, leaving the prominent sterile base crowned with the subglobose columella and spores attached to the convex center of the exoperidium, cells of sterile base next to stipe very small and whitish; mature gleba dark purplish-brown, in very old weathered specimens entirely disappearing and leaving only the sterile top-shaped base seated on the stipe, or sometimes the sterile base

breaks away entirely from the exoperidium, in which case it resembles very much the sterile base of a *Calvatia;* spores globose, faintly verrucose, brown, 3–5 μ in diameter; capillitium wine-colored to brown under microscope, threads very long, sparingly and very distantly branched, 7–10 μ thick, tapering to a slender point, septate in thicker portions, breaking up into segments some of which are 800 to 1000 μ long, walls smooth or often appearing as if filled with minute pits, lumen very small or none.

In rich, loose, sandy loam around base of old, rotting, post oak (*Quercus stellata*) stumps. Type collected at Denton, Texas, October 8, 1907, by W. H. Long (No. *2011*).[1] Other collections were made by the writer as follows: At Denton, Texas, September, 1906, and October 14, 1907 (Nos. *1671* and *2034*). The distinguishing features of this plant are its prominent persistent corky sterile base and its deciduous fragile endoperidium. It is a *Calvatia* among the geasters.

The genus is closely related to *Geasteropsis* Hollos, but differs from this plant in having a sterile persistent base to which the lower part of the endoperidium is firmly attached. According to the description and figures given by Hollos,[2] the dehiscent endoperidium of *Geasteropsis* encloses the subligneous stipe and columella making quite a different plant from the one here described.

Arachniopsis gen. nov.

Plants subglobose, terrestrial, peridium double, outer or exoperidium fragile, more or less deciduous; endoperidium cartilaginous, opening irregularly at apex; gleba consisting of a powdery mass of spores and capillitium without either columella or peridioles.

Arachniopsis albicans sp. nov.

Plants subglobose to irregularly globose, white, 5–20 mm. across, usually with a radicating base like a phalloid; exoperidium mealy to powdery, white, gradually weathering off; endoperidium cartilaginous, often very thin at apex, splitting into several irregular tooth-like segments at top, which are more or less incurved onto the gleba; gleba powdery, drab *en masse* consisting of spores and capillitium; spores subhyaline, with a greenish

[1] Unless otherwise stated all of the herbarium numbers cited in this article refer to the herbarium numbers of the writer.

[2] Hollos, L. Növényt. Közlem. **2**: 72–75. 1903.

tinge, obovate to subglobose, 3–5 μ long by 3–4 μ broad, faintly verruculose; capillitium present but rather scanty, hyaline, distantly septate and sparingly branched, 3–6 μ in diameter, somewhat granular, often breaking up into rather short segments, walls very thin.

In black soil of prairies under wire fences. Type collected by W. H. Long at Denton, Texas, December 27, 1908 (No. *2106*). Two other collections were made by the writer under wire fences in black soil in the same locality as follows: September, 1907 (No. *2008a*), and December 23, 1907 (No. *2052*). Some twenty specimens of this interesting little species were found during 1907 and 1908. The plants resemble externally, phalloid eggs which have failed to develop, but their internal structure is quite different from that of a phalloid. All of the fences on the prairies where this plant grows are made of barbed wire. In plowing the land the soil is thrown toward the fence, thus burying a large amount of vegetable debris; it is in such localities that this plant seems to thrive best.

This plant resembles in its manner of growth an *Arachnion*, but differs from this genus in having a true capillitium, a cartilaginous endoperidium, and no peridioles. Its peculiar habitat, its small size, and general resemblance to *Arachnion album* probably explain why it has not been found before.

Lysurus texensis Ellis (?)

"Eggs" in groups of several individuals, white, about 1 inch in diameter; stipe hollow, tapering toward base, reddish above, much paler below, 3–5 inches tall by 0.5 inch thick; walls of stipe of two layers of chambers thick, chambers 2–3 times as long as broad, opening outwardly occasionally but not inwardly, polygonal in cross section, pseudoparenchymatous, stipe crowned by a finger-like pileus; arms or fingers 4–5, at first joined by a thin membrane at apex, later separating, 0.3–0.5 inch long, tapering toward apex, hollow, pseudoparenchymatous, orange-red, transversely rugose, with a shallow furrow or suture along back of each, entirely covered by the gleba on sides and outer surface, inner faces or sides not gleba-bearing, expanding at base where joined to stipe into a thin, flat, lobed border, lobes as many as the arms and lying between their bases; gleba covering and completely hiding the outer surface of arms and border, having

much the appearance of a Phallus but when the gleba deliquesces the true nature of the pileus is seen, gleba foetid, black at maturity; spores of usual type of *Phallaceae*.

Collected in soil near a rotting strawstack, at Denton, Texas, 1907, by W. H. Long (No. *2000*). Six plants were found close together as if growing from a common mycelium, all in a semi-dried condition.

The writer has, with much hesitancy, provisionally assigned this plant to *Lysurus texensis* Ellis, since there was undoubtedly a plant of this character collected in Texas, although the description was not completed. It, however, may be only a red form of *Anthurus borealis* Burt.

LATERNEA COLUMNATA (Bosc.) Nees

A fine specimen (dried) of this plant has just been received from Texas. It has four columns and when fresh was undoubtedly red. A detailed description is unnecessary since the specimen is typical of this well known and widely distributed species. In soil (?), collected at Houston, Texas, January, 1917, by Geo. L. Fisher and communicated by B. C. Tharp (No. *6270*, Herb. Long). *Laternea triscapa* Turp. has also been reported from Texas and is supposed to be in the Ellis collection, but apparently the specimen is lost, since previous efforts to locate it failed.[3] It was probably *L. columnata*.

Six species of phalloids are now known from Texas, viz.: *Phallus impudicus* L. var. *imperialis* Schw., *P. rubicundus* Bosc., *Mutinus caninus* (Huds.) Fries, *Simblum sphaerocephalum* Schlecht., *S. texense* (Atk. & Long) Long, *Laternea columnata* (Bosc.) Nees, and *Lysurus texensis* Ellis (?).

Type material of *Geasteroides texensis* and *Arachniopsis albicans* has been deposited in the Pathological and Mycological Collections of the Bureau of Plant Industry, Department of Agriculture, Washington, D. C.

OFFICE OF INVESTIGATIONS IN FOREST PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
ALBUQUERQUE, N. MEX.

[3] Long, William H. The Phalloideae of Texas, Jour. Myc. 13: 113. 1907.

NORTH DAKOTA FUNGI—I

J. F. Brenckle

In this list an attempt is made to bring together all known North Dakota Fungi mentioned in earlier lists and papers, as well as those collected during the past seven years. The following gentlemen have contributed to the list with papers and collections:

Prof. A. B. Seymour's "List of Fungi Collected in 1884 along the Northern Pacific R. R." probably contains the first information that any fungi existed in Dakota Territory.

Then came Mr. C. G. Lloyd's "Letters" and "Mycological Notes," which report a number of species collected by Prof. L. R. Waldron, Miss L. Perrine, and myself.

Dr. Fred J. Seaver next published "Some North Dakota Hypocreales," "Discomycetes of North Dakota," and "Slime Moulds of North Dakota." He also issued three fascicles of exsiccati under the title of "North Dakota Fungi" during his stay in the state (1907–1908).

Lists of my collections have been published by Dr. Rehm, Dr. Sydow, and Prof. Saccardo. "Fungi Dakotenses" was started after Dr. Seaver left the state.

Prof. O. A. Stevens, of Fargo, has been an active collector for some years and has added many names to the list. Dr. J. Lunell, of Leeds, has contributed a number of species. Dr. J. R. Weir, Forest Pathologist, has sent specimens and a list of tree fungi found in the Sioux National Forest which borders on North Dakota on the southwest.

The kindly encouragement and help of Mr. Lloyd, Drs. Seaver, Arthur, Farlow, Clinton, Rehm, and Saccardo have made the list possible and to them may be attributed most of the determinations.

The data accompanying the names are, the host-names or substratum, place and date of collection, and the name of the col-

lector unless collected by myself. Subscribers to the author's "Fungi Dakotenses" will kindly note certain corrections in the names of fungi and hosts.

1. PHYCOMYCETES

Albugo Blitii (Biv.) Kuntze.
On *Amaranthus graecizans, A. blitoides,* and *A. retroflexus.* Kulm, Aug. 1911; Jamestown, Sept., 1884, Seymour.
(Fungi Dak. *136, 159, 159*a.)

Albugo candida (Pers.) Kuntze.
On *Brassica arvensis* and *Capsella Bursa-pastoris.* Kulm, July, 1908.
(Fungi Dak. *27, 27*a.)

Albugo Tragopogonis (Pers.) Kuntze.
On *Artemisia biennis* and *Ambrosia psilostachya.* Kulm, July, 1912.
On *Ambrosia trifida.* Bismarck, Aug., 1915.
On *Tragopogon porrifolius.* Fargo, July, 1915, Stevens.
(Fungi Dak. *158, 193, 327, 351.*)

Basidiophora Kellermanii (Ellis & Hals.) Wilson.
On *Iva xanthiifolia.* Kulm, 1911, Sykeston, Seaver.
(Fungi Dak. *28.*)

Cladochytrium major (Schroet.) Fish.
On *Rumex brittanica.* Kulm, June, 1910.
(Fungi Dak. *138.*)

Peronospora Arthuri Farl.
On *Anogra strigosa.* Kulm, June, 1910.
(Fungi Dak. *123.*)

Peronospora calotheca DeBary.
On *Galium boreale.* Kulm, June, 1913.
(Fungi Dak. *391.*)

Peronospora effusa (Grev.) Rahb.
On *Chenopodium album.* Kulm, July, 1912.

Peronospora gangliformis (Berk.) DeBary.
On *Lactuca pulchella.* Kulm, Aug., 1908.
(Fungi Dak. *390.*)

Peronospora leptosperma DeBary.
On *Artemisia biennis* and *A. ludoviciana.* July, 1912.
(Fungi Dak. *197, 336.*)

Peronospora Echinosperma Swingel.
On *Lapulus Lapulus.* Jamestown, June, 1913.
(Fungi Dak. *198.*)

Peronospora parasitica (Pers.) Tul.
On *Lepidium* sp. Jamestown, 1884, Seymour.

Peronospora Polygoni Thuem.
On *Polygonum convolvulus.* Kulm, June, 1913.

Peronospora Potentillae DeBary.
On *Potentilla pentandra.* Kulm, July, 1911.

Peronospora pygmaea Ung.
On *Anemone canadensis.* Kulm, July, 1911.
(Fungi Dak. *214.*)

Peronospora Trifoliorum DeBary.
On *Astragalus caroliniana.* Kulm, July, 1915; Bismarck, Seymour.
(Fungi Dak. *337.*)

Peronospora Viciae (Berk.) DeBary.
On *Vicia linearis.* Kulm, June, 1909.
(Fungi Dak. *124.*)

Physoderma Eleocharidis (Fuckel.) Schroet.
On *Eleocharis palustris.* Kulm, Oct., 1910.
(Fungi Dak. *39.*)

Pilobolus crystallinus (Wigg.) Tode.
On horse manure. Kulm, July, 1916.
(Fungi Dak. *394.*)

Plasmopara Halstedii Farl.
On *Ambrosia psilostachya.* Kulm, June, 1912.
On *Helianthus annuus, H. Maximiliani* and *H. subrhomboides.* Kulm, Sept., 1912.
On *Rudbeckia hirta.* Kulm and Bismarck, 1884, Seymour.
(Fungi Dak. *199*, *199*a, *238.*)

Synchytrium decipiens Farl.
On *Falcata comosa.* Bismarck, Seymour and Stevens.
(Fungi Dak. *349.*)

Sclerospora graminicola (Sacc.) Schroet.
On *Chaetochloa viridis.* Kulm, August, 1909.
(Fungi Dak. *86.*)

II. ASCOMYCETES

Amphisphaeria decolorans Rehm.
On dead bark of *Salix.* Kulm, November, 1913.
On dead bark of *Cornus stolonifera.* Whitestone Gully, 1916.

Anthostoma picaceum (Cooke & Ellis) Ellis & Everh.
On twigs of *Fraxinus lanceolata.* Wirch Lake, May, 1914.
The spores have a nucleus at each end, are somewhat curved but otherwise as described in Ellis & Everh.

Ascophanus carneus (Pers.) Boud.
On horse manure. Kulm, July, 1915.
On cow manure. Sykeston, Seaver.

Ascophanus cinereus (Crouan) Boud.
On horse dung. Woods near Fargo, Seaver.

Ascophanus crustaceus Starb.
On horse manure. Kulm, July, 1915.

Ascophanus testaceus (Moug.) Phill.
On old building paper. Fargo, Seaver.

Ascobolus immersus Pers.
Collected near Sykeston by Seaver.

Ascospora pseudhimantia Rehm n. sp.
On stems of *Aster paniculatus.* Fargo, June, 1915, Stevens.

Blitrydium fenestratum (Cooke & Peck.) Sacc.
On *Populus tremuloides.* Fargo, Seaver and Stevens.
(Fungi Dak. *303.*)

Biatorella campestris (Fries.) Th. Fries.
On moss sod. Kulm, July, 1914.
(Fungi Dak. *206.*)

Calosphaeria princeps Tul.
On *Prunus americana.* Kulm, July, 1913.

Cenangium furfuraceum (Roth.) Sacc.
On *Corylus americana.* Fargo, Seaver and Stevens.

Cenangium populneum prunicolum Rehm. n. var.
On *Prunus melanocarpa.* Kulm, May, 1914.
(Fungi Dak. *209.* The host was given as *P. virginiana* but Prof. Bergman corrects this to *P. melanocarpa.*)

Ceratostoma graphioides Sacc.
On fallen twigs of *Crataegus mollis.* Kulm, April, 1913.

Ceratostoma subrufum Ellis. & Everh.
On stems of *Rubus strigosus.* Kulm, March, 1916.

Ciboria sulphurella (Ellis. & Everh.) Rehm.
On Ash leaves. Fargo and Hawk's Nest, Seaver.

Coryne sarcoides (Jacq.) Tul.
On decaying logs. Fargo, Seaver.

Cordyceps militaris (L.) Link.
On larvae of insects. Fargo woods, Seaver.

Cordyceps pistillaris Berk. & Br.
On scale-insects. Fargo woods, Seaver.

Claviceps purpurea (Fries) Tul.
On *Secale cereale.* Emmons Co., August, 1915.
On *Bromus inermis, Elymus virginicus, Agropyron occidentale,* and *A. repens.*
(Fungi Dak. *328.*)

Claviceps nigriceps Tul.
On *Eleocharis palustris.* Kulm, August, 1908.
Fungi Dak. *33.*)

Claviceps microcephala (Wallr.) Karst.
On *Calamagrostis neglecta.* Kulm, August, 1908.
(Fungi Dak. *4.*)

Creonectria Coryli (Fuckel.) Seaver.
(Rehm calls it *Chilonectria inaurata* (Berk. & Br.) Sacc.)
On *Symphoricarpos occidentalis.* Kulm, March, 1910.

Creonectria coccinea (Pers.) Seaver.
On dead wood. Fargo, Seaver.

Creonectria verrucosa (Schw.) Seaver.
On *Acer Negundo* and *Populus deltoides.* Kulm.
(Fungi Dak. *213, 282.*)

Creonectria purpurea (L.) Seaver.
On *Prunus melanocarpa.* Kulm and Fargo, Seaver.
(Fungi Dak. *388.*)

Creonectria tuberculiformis (Rehm) Seaver.
On *Urtica gracilis.* Fargo, Seaver.

Cryptosphaeria millipunctata Grev.
On *Fraxinus lanceolata.* Kulm, May, 1911.

Cryptosphaeria populina (Pers.) Sacc.
On *Populus deltoides.* Kulm, September, 1912.
(Fungi Dak. *211.*)

Cucurbitaria Caraganae Elaeagni Rehm.
On *Elaeagnus argentea.* Kulm, July, 1914.
(Fungi Dak. *306.*)

Cucurbitaria conglobata Crataegi Rehm.
On *Crataegus mollis.* Kulm, May, 1911.

Cucurbitaria Crataegi (Schw.) Ellis & Everh.
On *Crataegus mollis.* Kulm, March, 1913.

Cucurbitaria Fraxini Ellis & Everh.
On *Fraxinus lanceolata.* Kulm, April, 1906.

Cucurbitaria Negundinis Wint.
On *Acer Negundo.* Kulm, November, 1913.

Cucurbitaria occulta Oudem.
On *Shepherdia argentea.* Kulm, June, 1913.

Cucurbitaria umbilicata Ellis.
On *Chrysothamnus graveolens.* Sentinal Butte, August, 1914, Stevens.

Daldinia vernicosa Schw.
On *Quercus macrocarpa.* Fargo, Stevens.
On *Fraxinus* and *Populus,* Kulm.

Dasyscypha Ivae Rehm, n. sp.
On dead *Iva xanthiifolia.* Kulm, April, 1913.

Dasyscypha nivea (Hedw.) Sacc.
On oak wood. Hawk's Nest, Seaver.

Diatrype albopruinosa (Schw.) Cooke f. *salicina* Rehm.
On *Salix.* Kulm, October, 1911.
(Fungi Dak. *160.*)

Diatrype americana Ellis & Everh. f. *Ostryae* Rehm.
On *Ostrya virginica.* Fargo, August, 1914, Stevens.
(Fungi Dak. *307.*)

Diatrype americana Ellis & Everh. f. *Quercus* Rehm.
On *Quercus macrocarpa.* Delaney's Ranch, August, 1915.

Diatrype asterostoma Berk. & Cooke.
On *Prunus melanocarpa.* Leeds, July, 1914, Lunell.

Diatrype dakotensis Rehm, n. sp.
On *Salix.* Kulm, December, 1914.

Diatrype Hochelagae Ellis & Everh.
On *Acer Negundo.* Kulm, August, 1911.

Diatrype linearis Ellis & Everh. f. *Salicis* Rehm.
On *Salix.* Kulm, December, 1913.

Diatrype radiata Ellis.
On *Ulmus americana.* Kulm, October, 1911.

Diatrype stigma (Hoff.) DeNot.
On *Salix.* Kulm, November, 1913.

Diatrype tristicha DeNot.
On *Rosa subnuda.* Kulm, May, 1913.
(Fungi Dak. *251.*)

Diatrype tumida Ellis & Everh. f. *Populi* Rehm.
On *Populus tremuloides.* Fargo, July, 1914.

Diatrype tumida Ellis & Everh. f. *Pruni* Rehm.
On *Prunus americana.* Fargo, July, 1914.

Diatrypella Frostii Peck.
On *Corylus americana.* Fargo, November, 1916, Stevens.
(Fungi Dak. *428.*)

Didymosphaeria brunneola Niessl.
On *Apocynum hypericifolium.* Kulm, November, 1913.

Didymosphaeria crastophila Niessl.
On *Andropogon scoparius.* Kulm, November, 1913.

Dothidella ulmea (Schw.) Ellis & Everh.
On *Ulmus americana.* Fargo, Spring, 1914.
(Better called "*Gnomonia ulmea* (Schw.) Thuem. see "Die Dothideales.") Ann. Mycol. **13**: 325. 1915.
(Fungi Dak. *329.*)

Dimerosporium Collinsii (Schw.) Sacc.
On *Amelanchier alnifolia.* Fargo, June, 1915.

Epichlae typhina (Pers.) Tul.
On *Koeleria cristata.* Kulm, June, 1909.
(Fungi Dak. *54.*)

Erysiphe Cichoracearum DC.
On the following hosts at various places: *Aster longifolius, A. multiflorus, A. paniculatus, Ambrosia trifida, Artemisia longifolia, Circium Floodmani, Grindelia squarrosa, Helianthus annuus, H. Maximiliani, H. tuberosus, Hydrophyllum virginicum, Iva xanthiifolia, Lactuca scariola, L. spicata, Plantago asiatica, P. major, Ratabida columnaria; Solidago Canadensis, S. mollis.*
(Fungi Dak. *139, 277, 277*a, *161, 161*a, *308, 308*a, *308.*)

Erysiphe Cichoracearum f. *Galeopsidi* (DC.) Salmon.
On *Stachys palustris.* Kulm, August, 1911.
(Fungi Dak. *162.*)

Erysiphe communis (Wallr.) Fries.
On *Anemone canadensis.* Kulm, September, 1914.
On *Glycyrhiza lepidota.* Berg, September, 1914, Stevens.
(Fungi Dak. *300, 309*a.)

Erysiphe graminis DC.
On *Poa pratensis.* Fargo, October, 1914, Stevens.

Erysiphe Polygoni DC.
On *Polygonum aviculare, P. erectum, Ranunculus abortivus, R. cymbalarius, Thalictrum purpurascens.* Fargo and Kulm, Stevens and Brenckle.
(Fungi Dak. *34, 121, 310, 378.*)

Entypa astera (Nitsch.) Fuckel.
On *Quercus macrocarpa.* Fargo, July, 1914.
(Fungi Dak. *311.*)

Eutypa Fraxini (Nitsch.) Sacc.
On *Fraxinus lanceolata.* Kulm, December, 1913.

Eutypa lata (Pers.) Tul.
On *Prunus americana* and *Quercus macrocarpa.* Kulm and Fargo.
(Fungi Dak. *163, 357.*)

Eutypa nitida Nitsch.
On *Salix.* Kulm, September, 1911.
(Fungi Dak. *164.*)

Eutypa scabrosa (Bull.) Auersw.
On *Fraxinus lanceolata.* Wirch Lake, May, 1914.
On *Salix.*

Eutypa velutina (Wallr.) Sacc.
On *Salix.* Kulm, October, 1911.

Eutypella angulosa Nitsch. f. *Negundinis* Rehm.
On *Acer Negundo.* Kulm, September, 1911.
(Fungi Dak. *165.*)

Eutypella angulosa Nitsch. f. *Fraxini* Rehm.
On *Fraxinus lanceolata.* Fargo, July, 1914.

Exoascus deformans Fuckel.
On *Prunus americana, P. melanocarpa,* and *P. Bessii.* Kulm and general in the state.

Exoascus Pruni Fuckel.
On *Prunus americana, P. melanocarpa,* and *P. Bessii.*
(Fungi Dak. *96.*)

Gibberella pulicaris (Fries) Sacc.
On *Zea Mays.* Fargo, August, 1907, Seaver.

Gloniopsis Gerardiana Sacc.
On oak. Fargo, Seaver.

Glonium lineare (Fries) DeNot.
On wood. Hawks Nest, 1908, Seaver.

Glonium parvulum (Gerard) Sacc.
On stumps. Fargo, 1907, Seaver.

Glonium stellatum Mühl.
On wood. Fargo, August, 1907, Seaver.

Galactinia succosa (Berk.) Cooke.
On soil in woods. Fargo, 1907, Seaver.

Geopyxis nebulosa (Cooke) Sacc.
On decaying log. Fargo, 1907, Seaver.

Graphyllium dakotense Rehm, n. sp.
On *Artemisia frigida.* Dickey Co., April, 1915.
On *Andropogon scoparius.* Kulm, November, 1913.
(Fungi Dak. *330.*)

Graphyllium graminis (Ellis & Everh.) Rehm.
On *Phragmites communis.* Dickey Co., November, 1914.
(Fungi Dak. *312.*)

Helotium citrinum (Hedw.) Fries.
On wood. Fargo, 1907, Seaver.

Helotium herbarium (Pers.) Fries.
On *Ambrosia trifida.* Kulm, August, 1913.

Helvella crispa (Scop.) Fries.
On moss sod. Cheyenne River, August, 1916.

Helvella elastica Bull.
On moss sod in woods. Cheyenne River, August, 1916.

Humaria deerata (Karst.) Sacc.
On old cabbage stems. Kulm, May, 1911.
(Fungi Dak. *140.*)

Humaria humosa Fries.
On moss sod. Kulm, May, 1908.

Humaria subhirsuta (Schum.) Karst.
On soil. Kulm, June, 1909.
(Fungi Dak. *141.*)

Hypocrea sulphurea (Schw.) Sacc.
On *Tilia americana.* Fargo, Seaver. Reported as *H. citrina* (Pers.) Fries.

Hypocrea patella Peck.
On old sphaeriaceous fungi. Fargo, Seaver.

Hypoderma Scirpinum DC.
On *Scirpus occidentalis.* Kulm, May, 1908.
(Fungi Dak. *142.*)

Hypomyces aurantius (Pers.) Fuckel.
On dead fungi. Woods, Fargo, Seaver.

Hypomyces Lactifluorum (Schw.) Tul.
On *Lactaria* sp. Fargo, August, 1907, Seaver.

Hypomyces ochraceus (Pers.) Tul.
On dead Agaric. Fargo, September, 1907, Seaver.

Hypomyces rosellus (Albert. & Schw.) Tul.
On logs. Fargo, Seaver.

Hyponectria dakotensis Seaver.
On *Ambrosia trifida.* Fargo, Seaver.

Hypomyces polyporinus Peck.
On *Polystictus versicolor.* Fargo, Seaver.

Hysterium Prostii Duby.
On *Cornus stolonifera.* Whitestone gully, October, 1916.

Hysteropatella Prostii (Duby.) Rehm.
On wood. Fargo, Seaver.

Hysterographium Fraxini (Pers.) DeNot.
On *Fraxinus lanceolata.* Fargo and Kulm, Seaver.
(Fungi Dak. *256.*)

Hysterographium Mori (Schw.) Rehm.
On oak wood. Fargo, Seaver.

Hysterographium Rousselii DeNot.
On dead *Salix.* Kulm, November, 1915.
(So determined by Dr. Rehm.)

Karschia lignyota (Fries.) Sacc.
On wood. Hawk's Nest, Seaver.

Karschia traveliana Rehm.
On log of Ash. Fargo, Seaver.

Lachnea albida Schaeff.
On moss sod. Anselm, August, 1916.
On wood. Fargo, Seaver.
(Fungi Dak. *407.*)

Lachnea erinaceus (Schw.) Sacc.
On log. Anselm, August, 1916.

Lachnea scutellata (L.) Sacc.
On wood and soil. Sykeston, Seaver.

Lachnea umbrata (Fries) Phill.
On soil. Kulm, May, 1910.

Laestadia Apocyni Ellis & Everh.
On *Apocynum hypericifolium.* Kulm, September, 1914.

Laestadia Scabiosae Lamb. & Faut.
On *Aster multiflorus.* Kulm, July, 1913.

Lamprospora detonia Brenckle.
On moss sod. Woods, Cheyenne river, August 13, 1916. According to Durand this is *Detonia scabrosa.*

Lasiobolus equinus (Muel.) Karst.
On horse dung. Sykeston, Seaver.

Leptosphaeria anthelmintica (Cooke) Sacc.
On *Chenopodium glaucum.* Kulm, September, 1913.

Leptosphaeria Artemisiae (Fuckel) Auersw.
On *Artemisia ludoviciana.* Kulm, November, 1913.
On *Artemisia caudata.* Glenn Ullin, July, 1915, Stevens.

Leptosphaeria borealis Ellis & Everh.
On *Salix.* Kulm, November, 1913.

Leptosphaeria Coniothyrium (Fuckel) Sacc.
On *Rubus strigosus.* Kulm, March, 1916.
(Fungi Dak. *384.*) (Not *Leptosphaeria fuscella.*)

Leptosphaeria conoidea DeNot.
On *Urtica gracilis.* Kulm, October, 1913.

Leptosphaeria consessa (Cooke & Ellis) Sacc.
On *Ambrosia psilostachya, A. trifida,* and *Helianthus subrhomboideus.* Kulm, August, 1913.
(Fungi Dak. *230.*)

Leptosphaeria culmifraga (Fries) Ces. & DeNot.
On *Agropyron tenerum.* Kulm, July, 1913.
On *Elymus hirsutiglumis.* Fargo, July, 1915, Stevens.

Leptosphaeria culmorum Auersw.
On *Elymus canadensis, Agropyron Richardsoni, Andropogon furcatus.* July, 1914.

Leptosphaeria Elymi Atk. (?)
On *Elymus canadensis.* Kulm, July, 1913.
Has spores somewhat longer and seven-septate, otherwise as described in Ellis & Everh.
(Fungi Dak. *231.*)

Leptosphaeria Erigerontis Berl.
On *Aster longifolius.* Kulm, August, 1913.
(Fungi Dak. *232.*)

Leptosphaeria Helianthi Ellis & Everh.
On Helianthus giganteus. Kulm, September, 1913.

Leptosphaeria Muhlenbergii (Ellis) Niessl.

Dr. Rehm after repeated examination of mature material sides with Niessl in placing this fungus with *Leptosphaeria* rather than *Dothidea*. (See N. Amer. Pyren., Ellis & Everh. p. 614.)

(Fungi Dak. *313*.)

Leptosphaeria nigricans inculta Sacc.

On old stems of *Grindelia squarrosa*. Kulm, August, 1913.

Leptosphaeria Onagrae Rehm, n. sp.

On *Onagra strigosa*. Kulm, July, 1913.

(Fungi Dak. *233*.)

Leptosphaeria planiuscula (Riess.) Ces. & DeNot.

On *Leptilon canadensis*. Kulm, July, 1913.

(Fungi Dak. *234*.)

Leptosphaeria tetonensis (Ellis & Everh.) Rehm.

Syn. *Melanomma occidentale tetonense* Ellis & Everh. (See N. Amer. Pyren. Ellis & Everh. p. 183.)

On *Artemisia frigida*. Kulm, November, 1908.

(Fungi Dak. *143*.)

Leptosphaeria Thalictri Winter.

On *Thalictrum dasycarpum*. Fargo, June, 1915.

Leptosphaeria trimeroides Rehm.

On *Liatris scariosa*. Kulm, August, 1913.

Leptosphaeria Typharum Karst.

On *Typha latifolia*. Kulm and Fargo, 1914.

(Fungi Dak. *334*.)

Lophiostoma Arundinis (Fries) Ces. & DeNot.

On *Phragmites communis*. Kulm, November, 1914.

On *Agropyron* sp. Kulm, October, 1915.

Lophiostoma caulicum (Fries) Ces. & DeNot.

On *Amaranthus graecizans*. Kulm, March, 1913.

Lophiostoma insidiosum (Desm.) Ces. & DeNot.

On *Aster multiflorus*. Kulm, July, 1913.

(Fungi Dak. *314*.)

Lophiostoma insidiosum f. *Salicis* Rehm.

On *Salix* sp. Kulm, December, 1913.

Lophiostoma macrostomoides DeNot.

On *Symphoricarpos, Salix,* and *Populus*. Kulm, 1913.

Probably identical with *L. triseptatum pleuriseptatum* Ellis & Everh.

(Fungi Dak. *147*.)

Lophiostoma Pruni Ellis & Everh.

On *Prunus americana* and *P. melanocarpa*. Kulm, 1913.

Lophiostoma Starbackii Karst.

On *Prunus melanocarpa*. Kulm, May, 1914.

Lophiostoma triseptatum pleuriseptatum Ellis & Everh.
On all the natural woods. General over the state.
(Fungi Dak. *147, 257, 314.*)

Lophiostoma triseptatum Peck. f. *Fraxini* Rehm.
On *Fraxinus lanceolata.* Wirsh Lake, May, 1914.

Macropodia macropus (Pers.) Fuckel.
On moss sod. Anselm, August, 1916.

Massaria conspurcata (Wallr.) Sacc.
On *Prunus americana.* Kulm, November, 1911.
(Fungi Dak. *166.*)

Melanomma minutum Berl.
On old *Salix.* Beaver Lake, July, 1908.

Melanomma occidentale (Ellis) Sacc.
On *Chrysothamnus graveolens.* Sentinal Butte, August, 1914, Stevens.

Melanomma pulvis-pyrus (Tetr.) Fuckel f. *Fraxini* Rehm.
On *Fraxinus lanceolata.* Kulm, April, 1908.

Melanopsamma improvita Karst.
On hail-injured apple tree. Kulm, January, 1914.

Melanopsamma salicaria (Karst.) Sacc.
On *Salix* sp. Kulm, December, 1913.

Melanopsamma salicaria (Karst.) f. *fallax* Sacc.
On *Salix.* Kulm, June, 1913.

Metasphaeria ambrosiaecola Atk.
On *Ambrosia psilostachya.* Kulm, August, 1913.

Metasphaeria ambrosiaecola Ivae Rehm.
On *Iva xanthiifolia.* Kulm, March, 1908.
(Fungi Dak. *144.*)

Metasphaeria ambrosiaecola praetans Rehm.
On *Ambrosia trifida.* Kulm, August, 1913.
Spores seven-septate.

Metasphaeria anisometra Cooke & Hark.
On *Dondia depressa.* Kulm, Aug., 1913.

Microsphaera Alni (Wallr.) Wint.
On *Corylus, Syringa, Viburnum lentago, V. prunifolium.* Fargo, Seaver and Stevens.
(Fungi Dak. *280, 280*a.)

Microsphaera Ravenelii Grev.
On *Lathyrus odoratus.* Fargo, October, 1914, Stevens.
On *Vicia linearis.* Belfield, August, 1914, Stevens.
(Fungi Dak. *281, 281*a.)

Microsphaera Symphoricarpi Howe.
On *Symphoricarpos occidentalis.* Valley City, Seymour.
(Fungi Dak. *212.*)

Mollisia atrata (Pers.) Karst.
On *Ambrosia trifida.* Fargo, August, 1907, Seaver.

Mollisia Dehnii Karst.
On *Potentilla norvegica.* Kulm, June, 1908; Fargo, Seaver. (Fungi Dak. *5.*)

Mollisia cinerea (Batsch) Karst.
On wood. Fargo, 1907, Seaver.

Nectria episphaeria (Tode) Fries.
On old sphaeriaceus fungi. Fargo, 1907, Seaver.

Nectria Peziza (Tode.) Fries.
On decaying log. Fargo, July, 1907, Seaver.

Morchella conica Pers.
On prairie. Kulm, June, 1908.

Morchella esculenta (L.) Pers.
Woods. Fargo, 1907, Seaver.

Nitschkea crustacea (Karst.) Sacc.
On old *Prunus melanocarpa.* Wirch Lake, May, 1914.

Nummularia repanda (Fries) Nitsch f. *querceti* Rehm.
On *Quercus macrocarpa.* Fargo, July, 1914.

Ophiobolus acuminatus (Sow.) Duby.
On *Circium Flodmanii.* Kulm, March, 1909.

Ophiobolus anguillides (Cooke) Sacc.
On *Ambrosia psilostachya* and *A. trifida.* Kulm, August, 1913. (Fungi Dak. *38, 236.*)

Ophiobolus Circii (Karst.) Sacc. f. *furcatus* Rehm.
On *Circium Flodmanii.* Kulm, July, 1913.

Ophiobolus claviger Hark.
On *Artemisia biennis* and *Iva xanthiifolia.* Kulm, July, 1913. (Fungi Dak. *237.*)

Ophiobolus collapsus Ellis & Everh.
On *Chenopodium album* and *Lappula Lappula.* Kulm, July, 1913.

Ophiobolus porphyrogonus (Tode) Sacc.
On *Brassica arvensis.* Kulm, August, 1913.

Otthia Crataegi Fuckel.
On *Crataegus mollis.* Kulm, May, 1911.

Parodiella grammodes (Kuntze) Cooke.
On *Psoralea argophylla.* Williston, August, 1915.

Patellaria atrata (Hedw.) Sacc.
On *Prunus melanocarpa.* Wirch Lake, May, 1914.

Patellaria clavispora (Peck) Sacc.
On willow and cottonwood. Fargo, Seaver.

Peroneutypa corniculata (Ehrh.) Berl.
On *Prunus melanocarpa*. Wirch Lake, May, 1914.
(Fungi Dak. *250*.)

Peziza badia Pers.
On soil in woods. Fargo, 1907, Seaver.

Peziza repanda Wallr.
On log in woods. Fargo, 1908, Seaver.

Peziza rutilans Fries.
On moss sod. Kulm, September, 1911.

Peziza vesiculosa Bull.
On soil and manure. Kulm; Sykeston, Seaver.

Pezicula Rosae Sacc.
On *Rosa* sp. Kulm, January, 1914.
(Fungi Dak. *392*.)

Pezizella dakotensis Rehm, n. sp.
On *Symphoricarpos occidentalis*. Kulm, July, 1913.

Phacidium Trifolii (Barsch) Boud.
On *Trifolium pratense*. Grandin, June, 1915, Stevens.

Phaeopeziza fuscocarpa (Ellis & Holw.) Sacc.
On old wood. Fargo, August, 1908, Seaver.

Phialea cyathoides (Bull.) Rehm.
On *Iva xanthiifolia*. Kulm, July, 1913.

Phialea Urticae (Pers.) Sacc.
On *Urtica gracilis*. Fargo, Seaver.

Phomatospora Rosae Rehm, n. sp.
On *Rosa* sp. Kulm, July, 1913.
(Fungi Dak. *284*.)

Phyllachora canaliculata Sacc.
On *Cyperus Schweinitzii*. Anselm, August, 1916, Stevens.

Phyllachora graminis Pers.
On many grasses. Kulm, 1909.
(Fungi, Dak. *8*, *9*.)

Phyllachora Tracyi Ellis & Everh.
On *Distichlis spicata*. Kulm, August, 1908.
(Fungi Dak. *10*.)

Phyllactinia suffulta (Reb.) Sacc.
On *Fraxinus lanceolata*. Fargo, September, 1914, Stevens.
(Fungi Dak. *286*.)

Physalospora Festucae (Liebret) Niessl.
On *Agropyron tenerum*. Kulm, November, 1913.

Physalospora megastoma (Peck) Woron.
On *Astragalus bisulcatus* and *A. goniatus*. Kulm, June, 1910.
(Fungi Dak. *11*.) Not *P. aurantica* Ellis & Everh.)

Pleonectria berolinensis Sacc.
On *Ribis rubrum* and *R. floridum*. Kulm, July, 1909. (Fungi Dak. *125, 239*.)

Pleosphaerulina corticola (Fuckel) f. *Rosae* Rehm.
On *Rosa* sp. Kulm, March, 1913.

Pleosphaerulina corticola (Fuckel) f. *Crataegi* Rehm.
On *Crataegus mollis*. Kulm, March, 1913.

Pleospora diaportheoides Ellis & Everh.
On *Helianthus Maximiliani*. Kulm, September, 1913.

Pleospora Lecanora (Falve) Rehm.
On *Salsola tragus*. Kulm, July, 1913. (Fungi Dak. *240*.)

Pleospora permunda Cooke.
On *Urtica gracilis*. Kulm, September, 1913.

Pleospora vagans Niessl.
On *Poa serotina*. Kulm, August, 1913.

Pleospora vulgaris Niessl. f. *astericola* Rehm.
On *Aster multiflorus*. Kulm, July, 1913.

Plowrightia morbosa (Schw.) Sacc.
On *Prunus Bessii, P. americana* and *P. melanocarpa*. (Fungi Dak. *97, 410*.)

Plowrightia Symphoricarpi Ellis & Everh.
On *Symphoricarpos occidentalis*. Kulm, April, 1909.

Podosphaera Oxyacanthae (DC.) DeBary.
On *Crataegus mollis*. Fargo, Stevens.
On *Prunus Bessii*, Dickenson, September, 1916.
On *Prunus americana* and *P. melanocarpa*.
(Fungi Dak. *146, 288*.)

Propolis faginea (Schrad.) Karst.
On old wood. Fargo, August, 1907, Seaver.

Pseudopeziza Medicaginis (Lib.) Sacc.
On *Medicago sativa*. Fargo, August, 1907, Seaver.

Pseudotthia Symphoricarpi (Ellis & Everh.) Rehm.
On *Symphoricarpos occidentale*. Kulm, February, 1913. (Fungi Dak. *98*.) Syn. *Otthia Symphoricarpi* Ellis & Everh.

Pyrenopeziza Absinthii (Lasch.) Rehm.
On *Iva xanthiifolia*. Kulm, March, 1910. (Fungi Dak. *215*.)

Saccobolus Kerverni (Crouan) Boud.
On cow dung. Sykeston, 1908, Seaver.

Saccobolus violascens Boud.
On horse dung. Sykeston, 1908, Seaver.

Sarcoscypha coccinea (Jacq). Cooke.
On wood. Fargo, 1907, Seaver.

Sarcoscypha occidentalis (Schw.) Cooke.
On old wood. Fargo, Seaver.

Schizoxylon Berkeleyanum (Dur. & Lev.) Fuckel.
On dead *Helianthus Maximiliani.* Kulm, April, 1913.

Schizoxylon compositum Ellis & Everh.
On *Prunus melanocarpa.* Kulm, May, 1914.

Schizoxylon decipiens Karst.
On *Apocynum hypericifolium.* Kulm, November, 1913.
(Fungi Dak. *264.*)

Schizoxylon decipiens Symphoricarpi Rehm.
On *Symphoricarpos occidentalis.* Kulm, April, 1909.

Schizoxylon insigne (DeNot.) Bres.
On *Crataegus mollis.* Kulm, March, 1913.
(Fungi Dak. *216.*)

Pyrenopeziza caricina (Lib.) Rehm.
On *Carex siccata.* Kulm, March, 19'5.

Pyrenophora echinella (Cooke) Berl.
On *Dondia depressa.* Kulm, August, 1913.

Rhopographus clavisporus (Cooke & T.) Ellis.
On *Phragmites communis.* Kulm, October, 1915.

Pyronema omphalodes (Bull.) Fuckel.
On burned over soil. Sykeston, 1908, Seaver.

Rhytisma salicinum Fries.
On *Salix spp.* Kulm, August, 1908.
(Fungi Dak. *48, 48*a.)

Rosellinia ovalis (Ellis) Sacc.
On *Chrysothamnus graveolens.* Sentinal Butte, August, 1914, Stevens.

Rosellinia pulveracea (Ehrh.) Sacc.
On various dead woods. Kulm, May, 1914.
(Fungi Dak. *99.*)

Rosellinia Rosarum (Niessl.) Rehm.
On *Rosa* sp. Kulm, May, 1913.

Rosenscheldia Heliopsidis (Schw.) Theis. & Syd.
Syn. *Bertiella Brenckleana* Rehm.
On *Aster multiflorus.* Kulm, March, 1910.
(Fungi Dak. *227.*)

Schizoxylon occidentalis. Ellis & Everh.
On *Fraxinus* and *Populus.* Kulm, June, 1913.

Scleroderris ribesia (Pers.) Karst.
On *Ribes floridum.* Kulm, May, 1913.
(Fungi Dak. *217, 217*a.)

Sordaria amphisphaerioides Ellis & Everh.
On horse dung. Kulm, November, 1913.

Sphaerella Fragariae (Tul.) Sacc.
On *Fragaria* sp. Kulm, August, 1908.

Sphaerella juniperina Ellis.
On *Juniperus prostrata.* Glenn Ullin, July, 1915, Stevens.

Sphaerella Yuccae Ellis.
On *Yucca glauca.* Mandan, July, 1915, Stevens.

Sphaerotheca Castagnei Lév.
On *Bidens vulgata, Collomia linearis, Taraxacum officinale,* and *Hydrophyllum virginianum.* Kulm and Valley City, Seymour.
(Fungi Dak. *149, 168, 219.*)

Sphaerotheca Humuli (DC|) Burrel.
On *Agrimonia hirsuta* and *Viola canadensis.* Kulm, 1909.
On *Geum canadense.* Wild Rice. August, 1914, Stevens.
(Fungi Dak. *296, 399.*)

Sphaerotheca Humuli fuliginea (Schw.) Salmon.
On *Taraxacum officinale.* Fargo, August, 1907, Seaver.

Sphaerotheca mors-uvae (Schw.) Berk. & Curt.
On *Ribes floridum.* Kulm and Valley City, Seymour.

Sphaerotheca pannosa (Wallr.) Lév.
On *Rosa carolina.* Fargo, September, 1914, Stevens.
(Fungi Dak. *297.*)

Sphaerulina corticola (Fuckel) Rehm.
On *Rosa* sp. Kulm, October, 1914.

Sphaerulina divergens Rehm, n. sp.
On *Elymus canadensis.* Kulm, July, 1913.

Sphaerulina Salicis Syd., n. sp.
On *Salix longifolia.* Kulm, February, 1913.
(Fungi Dak. *220.*)

Teichospora aberrans Rehm, n. sp.
On *Salix* sp. Kulm, December, 1913.

Teichospora fulgarata Ellis & Everh.
On *Populus deltoides.* Kulm, September, 1914.
(Fungi Dak. *321.*)

Teichospora Helenae Ellis & Everh.
On *Salix* and *Populus.* Kulm, April, 1914.
(Fungi Dak. *322.*)

Teichospora gregaria Ellis & Everh.
On *Fraxinus lanceolata.* Kulm, June, 1913.

Teicospora Pruni-americanae Rehm, n. sp.
On *Prunus americana.* Kulm, July, 1913.

Teichospora solitaria (Ellis) Ellis & Everh.
On *Artemisia canadensis.* Glen Ullin, July, 1915, Stevens.

Thecotheus Pelletieri (Crouan) Boud.
On dung. Woods, Fargo, 1907, Seaver.

Thyridana Fraxini Ellis & Everh.
On *Fraxinus lanceolata.* Wirch Lake, May, 1914.

Trichopeziza sulphurea (Pers.) Fuckel.
On herbaceous stems. Fargo, Seaver.

Trichopeziza Tiliae (Peck) Fuckel.
On *Tilia americana.* Fargo, 1907, Seaver.

Uncinula Clintonii Peck.
On *Tilia americana.* Ft. Ransom, August, 1916, Stevens.
(Fungi Dak. *424.*)

Uncinula macropus Peck.
On *Ulmus americana.* Fargo, October, 1914, Stevens.
(Fungi Dak. *298.*)

Uncinula necator (Schw.)Burrill.
On *Parthenocissus quinquefolia.* Fargo, October, 1914, Stevens.
(Fungi Dak. *299.*)

Uncinula Salicis (DC.) Wint.
On *Salix cordata.* Fargo, October, 1914, Stevens.
(Fungi Dak. *222, 300.*)

Urnula craterium (Schw.) Fries.
On dead wood. Fargo, 1907, Seaver.

Valsa ambiens (Pers.) f. *Crataegi* Rehm.
On *Crataegus mollis.* Kulm, March, 1913.
(Fungi Dak. *323.*)

Valsa ambiens (Pers.) f. *Elaeagni* Rehm.
On *Elaeagnus argentea.* Kulm, 1914.
(Fungi Dak. *324.*)

Valsa ambiens (Pers.) f. *Rosae* Rehm.
On *Rosa heliophylla.* Kulm, February, 1913.
(Fungi Dak. *3325.*)

Valsa ambiens (Pers.) Fries.
Also on *Rubus strigosua, Shepherdia argentia,* and *Ulmus americana.* Kulm, October, 1916. Whether the forms on each of these hosts should be listed separately as Dr. Rehm would have it I do not know.

Valsa americana Berk & Curt.
On *Prunus americana.* Fargo, 1914.

Valsa cincta Peck.
On *Prunus melanocarpa.* Kulm, May, 1913.
(Fungi Dak. *223.*)

Valsa fraxinina Peck.
On *Fraxinus lanceolata.* Kulm, June, 1913.
(Fungi Dak. *249.*)

Valsa salicina (Pers.) Fries.
On *Salix,* various species. Kulm, March, 1913.
(Fungi Dak. *224.*)

Valsa salicina (Pers.) Fries f. *tetraspora* Fries.
On *Salix longifolia.* Kulm, March, 1913.
(Fungi Dak. *169.*)

Valsa sordida Nitsch.
On *Salix longifolia.* Kulm, March, 1913.

Valsa Symphoricarpi Rehm, n. sp.
On *Symphoricarpos occidentalis.* Kulm, March, 1909.
(Fungi Dak. *150.*)

Valsa translucens DeNot.
On *Salix longifolia.* Kulm, March, 1913.

Valsaria moroides Acerina Rehm.
On *Acer Negundo.* Kulm, June, 1913.
(Fungi Dak. *250.*)

Valsella nigroqnnulata Fuckel.
On *Salix longifolia.* Kulm, March, 1913.
(Fungi Dak. *225.*)

Xylaria filiformis (Albert & Schw.) Fries.
On twigs. Kulm, April, 1908.

Zignoella Roripae Rehm, n. sp.
On *Roripa* sp. Kulm, December, 1913.

KULM, NORTH DAKOTA.

CULTURES OF UREDINEAE IN 1916 AND 1917[1]

J. C. Arthur

The present article is the fifteenth in a series of reports[2] by the writer upon the culture of plant rusts, beginning in 1899 and completing nineteen consecutive years. The preparation of the index and summary to the series, as stated in the report for last year, has been delayed, but together with a general retrospect is expected to appear in a succeeding number of this journal. After this, if work of the present character is continued, it will be reported in some other form.

Field Observations in 1916

The writer, by the courtesy of the botanical department of the Indiana Agricultural Experiment Station now under the direction of Professor H. S. Jackson, was enabled to make important observations in the field during 1916, which have proved of the utmost value, not only in detecting the alternate form of certain heteroecious species, but in securing a more adequate conception of the different aspects and range of hosts of particular species when occurring under unlike conditions or in the midst of plant societies composed of different elements.

The first trip of the year was to State College, Pa., in the last days of April, where Dr. F. D. Kern and his associates in the botanical department of the Pennsylvania State College gave every facility for a week's field work. Two excursions in the vicinity are especially worthy of mention, both taken under the personal direction of Professor C. R. Orton. An over-mountain road took us to Charter Oak, where the locality for the amphi-

1 Presented in part before the Botanical Society of America at the New York meeting, December 29, 1916.

2 See Bot. Gaz. **29**: 268–276; **35**: 10–23; Jour. Myc. **8**: 51–56; **10**: 8–21; **11**: 50–67; **12**: 11–27; **13**: 189–205; **14**: 7–26; Mycol. **1**: 225–256; **2**: 213–240; **4**: 7–33, 49–65; **7**: 61–89; and **8**: 125–141.

sporic *Carex* rust, *Puccinia microsora* Körn., was searched for clues to the alternate host without much success. A twelve-mile ride in another direction to Bear Meadow, an extensive mountain bog, gave opportunity to study the occurrence of *P. uniporula,* and some other difficult *Carex* forms.

On May 13 a western trip of a little over three weeks was begun. The first stop was a few days given to the study of the rust flora of the semi-arid plains between Grant and Ogallala in western Nebraska, where the second telial host for *Puccinia universalis* to be proven by cultures was found.

Next came a few days (May 18–22) at Laramie, Wyo., altitude of 7,500 feet, where the season was not sufficiently advanced for the best field work, but where through the courtesy of Professor Aven Nelson and the assistance of Mr. Edwin Payson an examination of the extensive and valuable Rocky Mountain Herbarium yielded many new hosts and localities for numerous western rusts.

Interesting observations were made (May 23–24) in the vicinity of Ft. Collins, Colo., where every attention was extended by members of the biological staff of the Agricultural College. Professor W. W. Robbins undertook to continue the observation of a number of clumps of *Astragalus* and *Oxytropis* as the season advanced. These plants were growing with masses of aecia-bearing *Euphorbia robusta* intermixed. On October 24 Professor Robbins reported that no rust had appeared on any of the plants of *Astragalus* or *Oxytropis* under observation. From European studies it has seemed probable that the perennial aecia on upright *Euphorbias* and the *Uromyces punctatus* on *Astragalus* and allied hosts, both especially abundant in the Rocky Mountains, were alternating forms of the same rust, but so far neither repeated attempts at cultures nor field evidence have afforded any support to the assumption.

At Windsor, Colo., as the guest of Mr. Geo. E. Osterhout (May 25), a fine display of over-wintered *Puccinia Distichlidis* on *Spartina* was seen in the field with an abundant growth of *Stieronema ciliatum* nearby. Telial material from this locality subsequently gave successful cultures, and on June 12 Mr. Osterhout sent aecia on *Stieronema,* which he obtained from the spot

visited. This is the second culture and the second aecial field collection so far secured.

At Denver the writer was joined by Professor H. S. Jackson. While here (May 26–31) we were under the guidance of Mr. Ellsworth Bethel, whose extensive knowledge of the flora of Colorado and especially his very intimate familiarity with the rust flora of the foot hills and plains about Denver, together with his highly enthusiastic and generous disposition, made the days memorable for the number and important character of the observations. Beside excursions immediately about Denver longer trips were taken through the Municipal Mountain Parks, to Pueblo, and to Boulder, all but the last by automobile with observations along the way. The rust flora of this region is the richest and most varied known to the writer, and the visit resulted in a large increase in knowledge regarding new forms and combinations. The identity of *Puccinia Schedonnardi* with *P. Muhlenbergiae,* the status of *Aecidium Abroniae, Aecidium Liatridis* and the aecia on *Polygonum aviculare,* heretofore erroneously associated with *Uromyces Polygoni,* were established, and much else accomplished. A visit to Mr. Bethel's garden, in which he carries out large numbers of open-air cultures, was most instructive as well as indicative of the highly valuable character of his studies.

The final stop (June 1–2) of the journey was at Manhattan, Kans., where over thirty years ago Professor W. A. Kellerman brought to light a number of forms still imperfectly known. By the aid of Mr. L. E. Melchers and other members of the Agricultural College a fruitful reconnaissance of the vicinity was made, resulting especially in detection of the alternate form for the *Aecidium* on *Allium,* which had tentatively been assigned by different observers to no less than four very unlike telial forms.

Such excursions for observation as those just mentioned have been of inestimable value in securing knowledge for the successful prosecution of the culture work. Without numerous cultures the marvelous advance of recent years in the taxonomic study of American rusts would have been largely impossible. Moreover, without the most varied cultures brought about by observations in widely separated parts of the country the intricate

relationships, transcending all deductions derivable from morphological study alone, must have remained unrecognized, or in so far as dimly apprehended be wholly without demonstration.

A number of correspondents assisted in securing needed material for the season's work, and to them thanks are due. There were available 170 collections with resting spores, and 9 with active spores as in *Aecidium* and *Gymnosporangium*. Some 452 tests were made in a hanging drop to determine the germinating condition of the spores. Only 69 collections of resting teliospores could be brought to germination from which 182 sowings were made, and 17 infections secured. From the 9 collections of fresh spores 12 sowings were made, and 3 infections secured. The work was largely performed by Mr. C. C. Rees, a member of the regular staff of the laboratory.

NEGATIVE RESULTS IN 1916.—Of the various attempted cultures which failed to produce inoculations two are worthy of record.

1. UROMYCES GRAMINICOLA Burr. on *Panicum virgatum* L., sent by Mr. E. Bartholomew from Stockton, Kans., was sown April 25 on *Euphorbia corollata*, and again May 25 on the same host, in both instances with no apparent result. In previous seasons the same species was sown on a number of other hosts,[3] but in the meantime from morphological and distributional data the conclusion had been reached that this form is probably correlated with *Puccinia Pammelii* on the same host, whose aecia are known to be on *Euphorbia corollata*. Other attempts at cultures should be made before abandoning the assumption.

2. PUCCINIA on *Carex Backii* Boott (*C. durifolia* Bailey) obtained by Mr. E. Bethel in February from near Denver, Colo., was sown April 7 on *Ribes Cynosbati, Boltonia asteroides* and *Urtica gracilis*, and again May 15 on the same hosts and on *Eleagnus argentea* and *Artemisia dracunculoides*. The same form obtained by Mr. Bethel in March from Boulder, Colo., was sown April 7, on *R. Cynosbati, B. asteroides*, and *U. gracilis*, and April 15, on *R. Cynosbati, U. gracilis*, and *E. argentea*.

[3] See Jour. Myc. **12**: 13. 1906; Mycol. **1**: 232. 1909; **2**: 220. 1910; **4**: 12. 1912.

Another collection sent from Valentine, Neb., by Rev. J. M. Bates, was sown May 26, on *R. Cynosbati, B. asteroides, U. gracilis* and *E. argentea*. All the sowings were without effect. All three collections gave fairly strong germination of the teliospores at the date of sowing.

Cultures have been attempted once before[4] on five hosts, all but one different from the above. The morphological characters of this form approximate those of *Puccinia Grossulariae* on various species of *Carex*, but nothing has yet been proven by cultures.

SUCCESSFUL CULTURES IN 1916 SUPPLEMENTING PREVIOUS WORK.—The culture of the following seven species adds valuable information in each case to the facts previously recorded.

1. PUCCINIA UNIVERSALIS Arth.—Material on *Carex filifolia*, collected by the writer May 18, 1916, at Ogallala, Neb., was sown June 2, on *Artemisia gnaphalodes*. Pycnia were detected June 15, but doubtless appeared earlier, being obscured by the heavy tomentum of the plant, and were followed by a large number of aecia, first seen June 28. This rust has been cultivated a number of times before[5] on various species of *Artemisia*, but only with telial material from *Carex stenophylla*. *Carex filifolia*, like *C. stenophylla*, occurs on semi-arid plains. It usually grows only three or four inches high, and in dense mats. It is locally known as "nigger-wool" or "black-root," from the tough, tangled mass of fine, black roots, resisting decay for a year or two when turned up by the plow and exposed to weathering.

2. PUCCINIA POCULIFORMIS (Jacq.) Wettst.—This very common stem rust of grasses and grains was grown on *Berberis vulgaris* from two collections made by Mr. G. E. Osterhout, Windsor, Colo., on March 2, one from *Sporobolus cryptandrus*, sown April 23, showing pycnia May 6, but not developing aecia, and the other from *Elymus canadensis*, sown May 15, showing pycnia May 25 and aecia June 6. Another collection on *Agropyron Smithii* made by Mr. E. Bethel, in Denver, Colo., March

[4] Mycol. **2**: 248. 1910.

[5] For previous cultures see Jour. Myc. **14**: 21. 1908; Mycol. **2**: 224. 1910; and **4**: 16. 1912.

6, was sown on *Berberis vulgaris* on April 23, and began to show pycnia April 30, and aecia May 4.[6]

3. PUCCINIA RHAMNI (Pers.) Wettst.—A collection made by Mr. G. B. Posey in December, 1915, at Corvallis, Oregon, on *Agrostis* sp., was sown May 11, on *Rhamnus Purshiana,* and showed pycnia in fair numbers May 20, but made no further development, although the leaves remained healthy and in good growing condition for a considerable time.

4. PUCCINIA DISTICHLIDIS Ellis & Ev.—This rust was found May 24 by Mr. Geo. E. Osterhout and the writer in great abundance on over-wintered *Spartina Michauxiana* in a field at Windsor, Colo., and entirely unmixed with any other rust known to occur on the same host. The spores had not yet germinated. Large groups of *Steironema ciliatum* nearby, the supposed alternate host, were already six or eight inches high and free from infection. The teliospores were sown on *S. ciliatum* in the greenhouse at Lafayette on May 30, and gave a heavy infection, showing pycnia June 4, and numerous aecia June 10. This result confirms the work of 1915[7] and establishes the life cycle of the species beyond doubt. On June 12 Mr. Osterhout sent a fine collection of aecia on *S. ciliatum* from the place where the cultural material had been obtained, being the second field collection for the species, the previous one being made in North Dakota.

5. PUCCINIA MUHLENBERGIAE Arth. & Holw. (*P. Schedonnardi* K. & S.).—Telial material of this rust was found May 28 by Professor H. S. Jackson and Mr. E. Bethel, on *Muhlenbergia gracillima,* a low, tufted and fine leaved species growing on the arid plains near Pueblo, Colo., associated with *Malvastrum coccineum,* suspected of being an alternate host. A sowing was made on *M. coccineum* June 2, which gave pycnia June 18, and aecia June 25, both in strong development.

Telial material of *Puccinia Schedonnardi,* on *Schedonnardus paniculatus* was obtained by Mr. Bethel, Professor Jackson and the writer at Pueblo, Colo. After the preceding trial showed signs of success, a striking resemblance was noticed between the

[6] For previous cultures see Jour. Myc. **8**: 53. 1902; **11**: 57. 1905; **12**: 17. 1906; **13**: 198. 1907; **14**: 16. 1908; Mycol. **2**: 227. 1910; and **4**: 18. 1912.

[7] See Mycol. **8**: 136. 1916.

two grasses in size and habit of growth and also between the gross appearance of the rusts they bore. The resemblance was furthermore found to extend to the microscopic features of the rusts. This led to sowing the teliospores upon *M. coccineum,* which was done June 23, and resulted in production of pycnia June 30, and aecia July 11. Although not so strong development as in the preceding case the gross and microscopic appearances were the same, and left no doubt that *P. Schedonnardi* is to be considered synonymous with *P. Muhlenbergiae,* a species of many races and hosts.[8] The middle of September subsequent to these cultures a letter was received from Mr. E. Bartholomew, of Stockton, Kans., in which he gives the following account of observations, most strongly confirming the conclusion reached from cultures. He says: "Standing in the doorway of the Mt. Nebo Presbyterian Church, three and one half miles south of our home, on June 11, 1916, I noticed, very close to the building, a large number of plants of *Malvastrum coccineum* profusely attacked by *Aecidium malvicola* Arth., and on examining the grasses growing among the *Malvastrum* there was found teleuto material on dead *Schedonnardus,* and on the developing young leaves and sheaths abundant uredo of *Puccinia Schedonnardi!* Continued examinations for several weeks, as the *Puccinia* developed into the III, led me to conclude beyond a peradventure that the aecium is no more nor less than I of this fungus as the grass was infected only in the near reach (not to exceed one rod) of the *Malvastrum.* While I have collected this *Puccinia* several times in the past ten years I have not come across *Aecidium malvicola* since May, 1904 (F. Col. No. 1905)."

6. PUCCINIA SUBNITENS Diet.—This rust is probably the most remarkable known for the number and diversity of its aecial hosts. The present addition of two families to the aecial hosts as previously recorded is entirely the result of information supplied by Mr. E. Bethel, who had made repeated observations of propinquity in the field, and verified his assumptions of relationship by cultural tests in his garden in Denver.

Telial material on *Distichlis spicata* obtained by Professor H.

[8] For previous cultures see Jour. Myc. **11**: 51. 1905; **13**: 192. 1907; Mycol. **1**: 251. 1909; **2**: 226. 1910; **4**: 18. 1912; and **7**: 82. 1915.

S. Jackson at Denver, Colo., May 26, was sown June 9 on *Abronia fragrans* (family Nyctaginaceae) and *Polygonum aviculare,* with infection only on the *Abronia,* on which pycnia began to appear June 15, and aecia June 19, in abundance. A collection on the same host made by the writer at Ft. Collins, Colo., May 23, was sown on *Polygonum aviculare* (family Polygonaceae) June 23, giving pycnia June 30, and aecia July 3, showing strong development.[9]

7. PUCCINIA LIATRIDIS (Ellis & And.) Bethel.—After repeated assurances from Mr. E. Bethel that he had found a rust on *Koeleria cristata* that would produce aecia on *Liatris,* and had cultured it in his garden, and having received material for study, successful sowings were made fully confirming his contention. A telial collection made by Mr. Bethel April 22, at Boulder, Colo., was sown May 4, on *Laciniaria punctata* (*Liatris punctata*), showing pycnia May 15, and aecia May 22. Another collection made by Mr. Bethel and the writer May 30, at Boulder, Colo., was sown on *L. punctata* June 23, showing pycnia July 3, and aecia July 7. The aecia have long passed under the name of *Aecidium Liatridis* Ellis & And., but the telial form has only recently been separated from the several other rusts on *Koeleria* in a paper by Bethel, in which he gives an account of his cultures, but which has not yet been received by the writer in printed form.

SUCCESSFUL CULTURES IN 1916 REPORTED NOW FOR THE FIRST TIME.—The following species have never been cultivated in America or elsewhere, so far as the writer knows.

1. UROMYCES SPOROBOLI Ellis & Ev. (*Aecidium alliicolum* Wint.).—On June 1 the writer in company with Messrs. L. E. Melchers, G. W. Putnam and H. S. Jackson explored a number of centers of infection of *Allium stellatum* showing aecia, found in great abundance in a field adjoining the campus of the Agricultural College at Manhattan, Kans. In one place a few uredinia were found on seedling grass about three inches high, ascertained to be *Sporobolus vaginaeflorus,* while over-wintered telia were

[9] For previous cultures see Bot. Gaz. **35**: 19. 1903; Jour. Myc. **11**: 54. 1905; **12**: 16. 1906; **13**: 197. 1907; **14**: 15. 1908; Mycol. **1**: 234. 1909; **2**: 225. 1910; **4**: 18, 54. 1912; and **8**: 135. 1916.

found on the dead plants of the same annual grass, all pointing to a genetic connection. Hard clumps of earth with the young grass were taken at some distance from the aecial areas and brought to the greenhouse at Lafayette. Whole plants of the *Allium*, in size and appearance much resembling the garden onion, on which were abundant aecia, were also taken, and on June 6 a sowing was made on the seedling grass, resulting in uredinia, first noticed June 21. Another lot of *Allium* plants from the same field, bearing aecia, was sent by Mr. Melchers about two weeks later, and another sowing made June 22, giving uredinia June 29. Neither cultures developed telia, owing to the difficulty in keeping the grass growing properly in the greenhouse. No uredinia appeared on any of the grass not used for inoculation.

The first cultural attempt with the telia of this rust was made fourteen years ago,[10] and again in 1910 and 1912, many hosts being used.[11] In 1912 the attempt was made to follow up observations by Mr. E. Bartholomew at Stockton, Kans., by sowing on *Allium reticulatum*, among other hosts, but with no success. Again this year Mr. Bartholomew sent telia on *Sporobolus neglectus*, which were sown on *A. reticulatum* and *A. canadense*, but again without success. No reason can be assigned for the failures.

2. PUCCINIA VERNONIAE B. & C.—A collection of this rust on dead stems of some undetermined species of *Vernonia*, obtained by Mr. C. H. Crabill at Cliffview, Va., March 9, was forwarded by Dr. F. D. Fromme. The sori were numerous and large, ranging from 0.5 to 1.5 cm. long. A sowing was made on the leaves of an undetermined species of *Vernonia*, which resulted in an abundance of pycnia, and some uredinia, but growth ceased before telia were formed. Exact dates were not secured, but the sowing was made about April 30, and the leaves removed for the herbarium on July 6, bearing pycnia and uredinia. This is the first record for pycnia of this very common rust. The life cycle shows that the species belongs in the genus *Bullaria*, in which it becomes **Bullaria Vernoniae** (B. & C.) comb. nov.

10 Bot. Gaz. **35**: 11. 1903.

11 See Mycol. **4**: 13. 1912; and **7**: 66. 1915.

SUMMARY FOR 1916

The following is a complete list of the successful cultures made during the year 1916. Those of the first series are species which have been previously cultured, but those of the second list have never been reported before.

A. SPECIES PREVIOUSLY REPORTED

1. PUCCINIA UNIVERSALIS Arth. Teliospores from *Carex filifolia* Nutt., sown on *Artemisia gnaphalodes* Nutt.

2. PUCCINIA POCULIFORMIS (Jacq.) Wettst.—Teliospores from *Sporobolus cryptandrus* (Torr.) A. Gray, *Agropyron Smithii* Rydb. and *Elymus canadensis* L., sown on *Berberis vulgaris* L.

3. PUCCINIA RHAMNI (Pers.) Wettst.—Teliospores from *Agrostis* sp., sown on *Rhamnus Purshiana* DC.

4. PUCCINIA DISTICHLIDIS Ellis & Ev.—Teliospores from *Spartina Michauxiana* Hitchc., sown on *Steironema ciliatum* (L.) Raf.

5. PUCCINIA MUHLENBERGIAE A. & H. (*P. Schedonnardi* Kellerm. & Sw.).—Teliospores from *Muhlenbergia gracillima* Torr., and from *Schedonnardus paniculatus* (Nutt.) Trel., sown on *Malvastrum coccineum* (Pursh) A. Gray.

6. PUCCINIA SUBNITENS Diet.—Teliospores from *Distichlis spicata* (L.) Greene, sown on *Abronia fragrans* Nutt., and *Polygonum aviculare* L.

7. PUCCINIA LIATRIDIS (Ellis & And.) Bethel.—Teliospores from *Koeleria cristata* (L.) Pers., sown on *Laciniaria punctata* (Hook.) Kuntze.

B. SPECIES REPORTED NOW FOR THE FIRST TIME

1. UROMYCES SPOROBOLI Ellis & Ev. (*Aecidium alliicolum* Wint.).—Aeciospores from *Allium stellatum* Ker., sown on *Sporobolus vaginaeflorus* Torr.

2. PUCCINIA VERNONIAE B. & C.—Teliospores from *Vernonia* sp., sown on the same host.

CULTURES IN 1917

No trips for observation were taken during this year, and the usual amount of time bestowed on the cultures was greatly reduced. About 25 collections with resting spores and 6 with active spores, the latter all forms of *Aecidium,* were available for the tests. About 120 drop cultures were made from the sets of resting spores, showing that 15 of the collections were more or less viable at the time. From the fifteen collections 14 successful inoculations were secured, 103 sowings having been made. The work was partly done by Mr. C. C. Rees and partly by Dr. E. B. Mains, members of the laboratory staff.

NEGATIVE RESULTS IN 1917.—It seems worth while to call attention to three attempts which wholly failed, with the hope that some one may be aided in solving the problems involved.

1. PUCCINIA TRITICINA Erikss. on *Triticum vulgare* Mill. was obtained from the border of a wheat field in September, 1916, by Mr. C. C. Rees, and sown on *Clematis Flammula* L., May 17 following, but with no result. The teliospores, however, were germinating very feebly. The conclusion was reached some two years ago from morphological and other data, that the common leaf rust of wheat is a race of the common *P. Agropyri* E. & E., occurring upon many wild grasses. *P. Agropyri* from *Agropyron glaucum* was cultured on *Clematis Vitalba* L. in Germany by Dietel in 1892. In America cultures have shown races to exist in eastern United States between *Bromus ciliatus* and *Clematis virginiana,* in Colorado between *Elymus canadensis* and *Agropyron Smithii* and *C. ligusticifolia,* in Texas between *Elymus virginicus* and *C. Drummondii,* and in North Dakota between *E. canadensis* and *Anemone cylindrica.* As *Clematis Flammula* and *C. Vitalba* are almost the only common Ranunculaceous plants through the wheat growing regions of southern Europe, northern Africa and western Asia, an area that probably includes the home of the original wild wheat, the assumption is reached that one or both these hosts can be made to bear aecia from *P. triticina* under favorable conditions.

2. PUCCINIA EMACULATA Schw. on *Panicum capillare* L. was sown May 8 on *Euphorbia corollata,* and May 9 on *E. commutata*

with no infection, from material obtained by Prof. H. S. Jackson in southern Indiana. Another collection secured by Dr. E. B. Mains at Lafayette, Ind., was sown May 17 on *E. corollata,* and again May 24, June 5 and 13, on *E. Ipecacuanhae,* with no infection. In each case the teliospores showed fair germination and the hosts were in excellent condition. Judging from morphological and host data these species of *Euphorbia* would be probable aecial hosts, but all attempts at cultures[12] have so far failed. I am indebted to Prof. J. B. S. Norton, botanist of the Maryland Agricultural Experiment Station, for a number of serviceable plants of *E. Ipecacuanhae.*

3. PUCCINIASTRUM HYDRANGEAE (B. & C.) Arth., on *Hydrangea arborescens* L., collected by Dr. E. B. Mains at Lafayette, Ind., March 31, 1917, was sown May 12 on *Tsuga canadensis, Abies balsamea, Abies concolor,* and *Picea canadensis,* with no infection. Although no clues had been obtained from field observation, yet these genera of hosts include all on which any species of *Pucciniastrum* has yet been grown, and the teliospores were germinating freely, so there had been reasonable hopes of success.

SUCCESSFUL CULTURES IN 1917 SUPPLEMENTING PREVIOUS WORK.—The successful attempts to connect the aecia on *Iris versicolor* and on *Rudbeckia laciniata* with telial forms are the culmination of efforts extending over several years, in which a number of persons have aided. Similar efforts to connect the localized aecia on *Houstonia caerulea* and on *Capnoides montanum* have so far been without success, that is, for this laboratory.

1. PUCCINIA MAJANTHAE (Schum.) Arth.—This year for the first time American material of this widely distributed and highly specialized rust has been cultured. The work was first done by Prof. H. H. Whetzel at Ithaca, N. Y., in verification of observations at North Spencer, N. Y., made during the season of 1916 by Prof. Whetzel and Prof. H. S. Jackson. The account of the work has not been published at the time of this writing. Both before and after Prof. Whetzel had obtained his results he sent

[12] For previous attempts see Bot. Gaz. **35**: 12. 1903; Jour. Myc. **8**: 52. 1902; **10**: 10. 1904; **12**: 12. 1906; **13**: 192. 1907; **14**: 11. 1908; Mycol. **1**: 230. 1909; **7**: 65. 1915; and **8**: 127. 1916.

material and gave all possible aid in duplication of his work here in Indiana.

The teliospores from *Phalaris arundinacea*, obtained by Prof. Whetzel at North Spencer, N. Y., Nov. 6, 1916, were sown May 16 on *Iris versicolor*, and again May 17 on *I. versicolor*, and also on *Polygonatum commutatum*, *Vagnera racemosa*, *Convallaria majalis* and *Allium stellatum*. On May 19 they were sown on *Polygonatum biflorum* and May 20 on *Maianthemum canadense*. Only infection took place on *Iris*, the first sowing showing copious pycnia on May 21 and aecia on May 30, while the second sowing gave pycnia May 23 and aecia June 1. The only previous similar attempt was made in the cultures for 1910[13] when telial material from South Dakota was sown on *Polygonatum commutatum*, *Vagnera stellata*, *Convallaria majalis*, *Uvularia grandiflora* and *Trillium cernuum* with no infection. It is likely that *Puccinia Majanthae* has aecia on all the hosts named, but if so the occurrence of strongly pronounced biological strains prevented infection in the two tests.

2. Puccinia subnitens Diet.—For a number of years the aecia on *Capnoides* (*Corydalis*) known as *Aecidium fumariacearum* Kellerm. & Sw., have been associated with the telia on *Distichlis spicata* from morphological and host considerations, but the cultures were not made until the present season, although several times attempted. In June Mr. E. Bethel sent aecia on *C. montanum* grown in his garden from teliospores on *D. spicata* secured at Berkeley near Denver, Colo.

Some of the same collection of telia was transmitted by Mr. Bethel and on June 14 the teliospores were sown on *Abronia fragrans*, *Capnoides montanum* and *Chenopodium album*, with infection only on the last host, giving pycnia June 21, and aecia June 23. Another sowing was made June 21 on *C. montanum*, but gave no infection. Possibly the lateness of season prevented success with the *Capnoides* although the more susceptible *Chenopodium* was infected.

3. Uromyces seditiosus Kern.—Observations were made by Dr. F. D. Fromme and the writer in 1914 at Houston, Texas, which appeared to show that this rust sometimes forms aecia on

[13] Mycol. 4: 11. 1912.

Houstonia caerulea, and since then efforts have been made to secure suitable material with which to make tests. With this in view teliospores from a collection on *Aristida ramosissima* made by Prof. H. S. Jackson at Elberfield, Ind., were sown on *H. caerulea,* but without result. Again teliospores from a collection made by Prof. C. D. Learn on *A. basiramea* at Stillwater, Okla., were sown May 24 on *H. caerulea, Plantago Rugelii, P. lanceolata* and *P. aristata,* with infection only on the last two hosts, giving pycnia June 4 and aecia June 7, both in abundance.[14]

4. UROMYCES PERIGYNIUS Halst.—Aecia have been collected on *Rudbeckia laciniata* in the central west from Montana to Wisconsin, Nebraska and Indiana for which telial connection has been sought for some time.[15] Field observations made by Prof. E. W. D. Holway at Excelsior near Minneapolis, Minn., during 1916, pointed definitely to telia on a *Carex.* The material sent by Prof. Holway was *U. perigynius* on *C. sparganioides,* and was sown May 17 on *Solidago canadensis, Aster lateriflorus* and *Rudbeckia laciniata,* with exceedingly abundant infection on the last host, showing pycnia May 21 and aecia May 29. The *Solidago* and *Aster* remained free of rust. Evidently *Rudbeckia* acts as a racial host for this rust parallel with *Aster* and *Solidago.*

SUCCESSFUL CULTURES IN 1917 REPORTED NOW FOR THE FIRST TIME.—Both of the following species introduce questions of relationship which it is impossible at the present time fully to answer.

1. PUCCINIA SPOROBOLI Arth.—Observations were made by Dr. J. F. Brenckle at Kulm, N. Dak., which pointed distinctly to the connection of this rust with aecia on *Lilium umbellatum,* and material consisting of telia on *Sporobolus heterolepis* and bulbs of *L. umbellatum* were sent in the fall of 1916, with which to test the matter. Further telial material was sent the following spring. A sowing was made April 26 and again April 30 and May 1 on a garden lily, *L. elegans* Thunb., closely resembling *L. umbellatum,* the Dakotan plant not being in leaf, but with no infection. On May 16 two sowings were made on the same host and also on

[14] For previous cultures on Plantago see Bot. Gaz. **35**: 17. 1903.

[15] For unsuccessful tests see Jour. Myc. **12**: 12, 13, 14, 25. 1906; **13**: 191, 192, 202. 1907; Mycol. **1**: 229, 230, 251. 1909; **2**: 218. 1910; **4**: 9, 12, 13, 28. 1912.

L. umbellatum, with no infection on the first, and with abundant infection on the latter, showing pycnia May 23 and aecia May 29. Another sowing was made May 29 on *Vagnera stellata, Uvularia grandiflora, Maianthemum canadense, Allium stellatum,* all with no infection, and also on *A. Nuttallii* giving pycnia June 4, and aecia June 9, and on *A. cernuum* giving pycnia June 9, and aecia June 12, both in abundance. Sowings June 5 on *A. stellatum* and *A. canadense* gave no result.

Although the host of this rust is one of the principal prairie grasses of the western plains, yet the rust has been collected only in three localities, one at Decorah, Iowa, in 1884, 1901 and 1902, one at Ewing, northwestern Nebraska, in 1899, and the third a recent find at Kulm, N. Dak. It differs from all other American grass rusts in having the pores of the urediniospores near the hilum.

Last year *Uromyces Sporoboli* E. & E. on *Sporobolus vaginaeflorus* was connected with aecia on *Allium* from Kansas material. The aecia from the two species seem to be indistinguishable by any technical character. The suggestion at once arises that the two forms may be genetically correlated. Examination of the telia supports this hypothesis, for the mesosporic teliospores of the *Puccinia* are indistinguishable in size and appearance from the teliopores of the *Uromyces,* but on the other hand the urediniospores of the *Puccinia* are considerably smaller than those of the *Uromyces* and somewhat thinner walled. The greatest difference, however, lies in the arrangement of pores of the urediniospores. In the *Puccinia* they are three or four and basal, while in the *Uromyces* they are four and equatorial.

A particularly close correlation appears to exist between *Puccinia Cryptandri* E. & B. on *Sporobolus cryptandrus* and *U. Sporoboli,* both in uredinia and telia, although the urediniospores of P. *Cryptandri* are inclined to assume a winter resting condition with thicker walls. Unfortunately no suitable culture of *P. Cryptandri* has yet been made, and the aecia are unknown, but it may be assumed that they will be found to occur on *Allium* or a closely related host.

Putting together what is now known regarding these three forms of rust on *Sporobolus* and comparing with what is known of the

forms of rust on *Carex* going to Ribes, *P. Grossulariae* (Schum.) Lagerh. (*P. uniporula* Orton),[16] we seem justified in assuming that the grass forms in question represent one species made up of morphologico-physiological races, just as the sedge forms appear to do, but the proof is not so complete. The marked differences in the urediniospores of *P. Sporoboli, P. Cryptandri* and *U. Sporoboli,* are all such as can be harmonized with the assumption that the three forms represent only the races of one species, although it does not seem necessary now to go into the required explanation to make the matter perfectly clear. However, for convenient taxonomic reference, and until the relationship is more firmly established, it will be best to treat *P. Sporoboli, P. Cryptandri* and *U. Sporoboli* as independent species.

2. UROMYCES ON SPARTINA.—Field observations by Dr. J. F. Brenckle were made during the spring of 1915 at Kulm, N. Dak., which seemed to indicate connection between aecia on *Vagnera stellata* and the common *Uromyces* on *Spartina.* Such a connection seemed to be strengthened by later observations. On May 31, 1916, Dr. Brenckle says in a letter to the author: "Yesterday I went over my station carefully and found the infected plants of *Smilacina* [*Vagnera*] invariably accompanied by rusted *Spartina.* I noted also a number of well infected leaves, each of which was overhung and scraped on by a rusted leaf of *Spartina.* As the infection of *Smilacina* is only in the pycnial state it probably has not spread away from its original telial source. The *Smilacina* is abundant but the infected plants are sharply confined to those patches also inhabited by the *Spartina.* One such patch had plants of *Smilacina* which were *not* infected. I was disappointed that my theory was not proving correct until I noticed that the *Spartina had no rust.*"

With such strong circumstantial evidence the success of cultures undertaken with telial material supplied by Dr. Brenckle still came as a surprise, for three or four races of the *Uromyces* on *Spartina* are already well known having aecia on three families of dicotyledonous hosts, and no heteroecious rust has heretofore been discovered having aecia on both monocots and dicots.

On May 11 teliospores from *Spartina Michauxiana* were sown

[16] Mycol. 4: 13. 1912; 7: 66, 78. 1915.

on *Vagnera* (*Smilacina*) *stellata, Polygonatum biflorum* and *Steironema ciliatum,* with infection only on the first two, giving pycnia May 18, and aecia May 25, both in the greatest abundance and vigor. Another sowing was made May 19 on *Polygonatum biflorum,* showing pycnia May 28 and aecia June 7, also on *P. commutatum,* showing pycnia May 27 and aecia June 6, and furthermore on the following which were not infected: *Uvularia grandiflora, Maianthemum canadense, Vagnera racemosa, Iris versicolor* and *Trillium recurvatum.* Still another sowing was made May 23 on *Steironema lanceolatum* without infection, and May 29 on *U. grandiflora, M. canadense, V. racemosa* and *V. stellata,* with infection only on the last, only pycnia showing June 6, doubtless owing to the lateness of the season.

Upon studying the microscopic characters of the material here recorded the form is seen to readily fall into the species given in the North American Flora (7: 231) as *Nigredo Polemonii* (Peck) Arth. The aeciospores on *Vagnera* and *Polygonatum* are much larger (18–29 by 19–35 μ) than those on the same hosts which have been assigned to *Puccinia Majanthae* (Schum.) Arth. (15–21 by 16–27 μ), and have thicker walls, being characters by which the two species may be separated. A collection on *Vagnera stellata* from the valley of the Teton in northern Montana was some years ago made a new species under the name of *Aecidium magnatum* Arth., on these same characters. The aeciospores are somewhat larger than those on the other races of the *Uromyces* on *Spartina,* although there is a gradation in size within certain limits for the four races. In fact the four races of this species exhibit not only physiological specialization, but a certain amount of morphological differentiation of both aecia and telia, together with considerable geographical segregation.

For convenience in discussion of these races there would be some advantage to have distinctive names. The following outline will fairly well show the present morphologico-physiological divisions with geographical distribution, and corresponding names.

UROMYCES POLEMONII (Peck) Barth. (*Nigredo Polemonii* Arth.)

Aeciospores 14–19 by 15–23 μ, on *Caryophyllaceae.*

Teliospores generally broad and rounded above.

I. Salt marshes of coast, Nova Scotia (III also in Delaware and Florida), and Southern California (III not known on Pacific coast)............................*Uromyces Spartinae* Farl.

Aeciospores 15–23 by 16–26 μ, on *Polemoniaceae.*

Teliospores narrow and mostly acuminate above.

I. Dry plains and thickets, Indiana and Wisconsin to North Dakota and foothills of Colorado (III same).

Uromyces acuminatus Arth.

Aeciospores 16–23 by 18–29 μ, on *Primulaceae.*

Teliospores mostly blunt or truncated above.

I. Moist plains, Central Indiana to Central Wisconsin and foothills of Colorado and Wyoming (III same).

Uromyces Steironematis nom. nov.

Aeciospores 18–30 by 19–35 μ, on *Convallariaceae.*

Teliospores generally blunt or acute.

I. Lake or river banks, Buffalo, N. Y., to Central Montana and Nebraska (III North Dakota)..**Uromyces magnatus** comb. nov.

The collection used for the initial culture may be taken as type of *U. Steironematis.* It was collected at Palmer, Neb., March 22, 1905, on *Spartina Michauxiana* Hitchc., by Rev. J. M. Bates, and was successfully sown May 26, 1905, on *Steironema ciliatum.*[17]

The forms of the teliospores and the habitats of the four forms are to be taken only as the general expression of the races, and are of no real diagnostic value except as associated with other characters. Both acuminate and rounded teliospores can usually be found in the same sorus, but the impression given by a microscopic mount from specimens of the first race is generally that the spores are prevailingly rounded above, from the second race, acuminate, etc.

The aecia of *U. Spartinae* have been collected on *Arenaria* and *Tissa* in Nova Scotia and southern California; those of *U. acuminatus* on *Collomia, Gilia, Phlox* (three species) and *Polemonium,* in Colorado, Indiana, Iowa, Minnesota, Nebraska, North Dakota, South Dakota and Wisconsin; those of *U. Steironematis* on *Dodecatheon* and *Steironema,* in Colorado, Illinois, Iowa, Kansas, Nebraska, North Dakota, South Dakota, Wisconsin and Wyoming; and those of *U. magnatus* on *Polygonatum* (two species) and *Vagnera* (two species), in Illinois, Iowa, Minnesota, Montana, Nebraska, North Dakota, South Dakota and Wisconsin.

[17] Jour. Myc. **12**: 25. 1906.

Exsiccati material representing aecia has been issued as follows: for *U. Spartinae* none; for *U. acuminatus,* Barth. F. Columb. *2605,* Barth. N. Am. Ured. *597,* Brenckle, F. Dak. *102,* Ellis, N. Am. F. *1008,* Rab.-Wint. F. Eur. *3637;* for *U. Steironematis,* Barth. F. Columb. *2288,* Brenckle, F. Dak. *134, 259,* Ellis, N. Am. F. *1424,* Sydow, Ured. *2401;* and for *U. magnatus,* Barth. F. Columb. *4162, 4467, 4764,* Barth. N. Am. Ured. *661, 1074, 1170, 1269,* Brenckle, F. Dak. *1, 226,* Griff. West Am. F. *243,* Sydow, Ured. *2298.*

SUMMARY FOR 1917

A. SPECIES PREVIOUSLY REPORTED

1. PUCCINIA MAJANTHAE (Schum.) Arth.—Teliospores from *Phalaris arundinacea* L., sown on *Iris versicolor* L.

2. PUCCINIA SUBNITENS Diet.—Teliospores from *Distichlis spicata* (L.) Greene, sown on *Chenopodium album* L.

3. UROMYCES SEDITIOSUS Kern.—Teliospores from *Aristida basiramea* Engelm. sown on *Plantago aristata* Michx. and *P. lanceolata* L.

4. UROMYCES PERIGYNIUS Halst.—Teliospores from *Carex sparganioides* Muhl., sown on *Rudbeckia laciniata* L.

B. SPECIES REPORTED NOW FOR THE FIRST TIME

1. PUCCINIA SPOROBOLI Arth.—Teliospores from *Sporobolus heterolepis* A. Gray, sown on *Allium cernuum* Roth., *A. Nuttallii* S. Wats., and *Lilium umbellatum* Pursh.

2. UROMYCES MAGNATUS Arth.—Teliospores from *Spartina Michauxiana* Hitchc., sown on *Polygonatum biflorum* (Walt.) Ell., *P. commutatum* (R. & S.) Dietr., and *Vagnera stellata* (L.) Morong.

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THE PECK TESTIMONIAL EXHIBIT OF MUSHROOM MODELS

HOMER D. HOUSE

It is peculiarly fitting at this time to describe rather briefly the exhibit of mushroom models, recently installed in the State Museum at Albany, New York, as a memorial to the life and service of the late Charles Horton Peck, state botanist of New York from 1867 to 1915, a period of 48 years, of which all but the last two years were spent in active service.

The final installation of these remarkable mushroom models was completed only a few days prior to his death, which occurred on July 10, 1917. The models, fifty-seven in number and representing fifty-five species of edible and poisonous mushrooms, are the work of Mr. Henri Marchand, an artist and sculptor of rare ability. The models are made of wax from casts in the field and reproduce, with perfect fidelity to nature, the form, coloring, and habitat of each species.

Space need not be taken to enumerate the entire list of species which are represented in the collection, which includes:

POISONOUS

Amanita phalloides
Amanita muscaria
Clitocybe illudens
Russula emetica
Inocybe asterospora

EDIBLE OR HARMLESS

Amanita caesarea
Tricholoma sejunctum
Tricholoma personatum
Russula cyanoxantha
Russula virescens
Lepiota procera
Lepiota naucina
Agaricus campester
Agaricus arvensis
Coprinus comatus
Morchella deliciosa
Gyromitra esculenta
Strobilomyces strobilaceus
Pleurotus ostreatus
Fistulina hepatica
Armillaria mellea
Boletus cyanescens
Polyporus sulphureus

The services rendered by Doctor Peck in the field of mycology are surpassed by no other American student of fungi. His work, although not confined to the fleshy fungi, is best known from the hundreds of species which he has described in the fleshy and woody groups of fungi (Agaricaceae, Boletaceae, Hydnaceae, and Clavariaceae).

Without the advantages of European travel and study, and frequently working without access to the older European literature upon fungi, his work stands out with conspicuous individuality. That he has apparently described, in some cases, species already described by the older mycologists of Europe is no reflection upon his remarkable ability in the discernment of specific and generic characters of our native species.

His work will stand for all time as the foundation upon which later students of the fungi may build with safety a more elaborate morphological and systematic revision of the fleshy and woody groups of fungi.

Those friends, admirers, and fellow botanists who have contributed toward bringing into existence this testimonial exhibit of mushroom models, may well feel that there is no more suitable memorial possible. There are few pages of modern literature dealing with the fleshy and woody fungi that do not reflect in some degree the individuality of Doctor Peck's work, and looking at these models in the State Museum, with their exquisite variety of form and color, one may imagine with what pleasure and appreciation they would be viewed by him whom they memorialize.

EDUCATION BUILDING,
ALBANY, NEW YORK.

NOTES AND BRIEF ARTICLES

Professor W. T. Horne, of the State University of California, spent about six weeks at the Garden this summer after his return from Cuba, investigating the cytology and morphology of *Armillaria mellea*.

In an article in *Phytopathology* for February, A. S. Rhoads gives new hosts for a number of our common wood-destroying fungi and urges collectors to use more care in determining and listing the hosts of this class of fungi.

Sandy sporophores of *Fomes pinicola* are described and figured by A. A. Hansen in *Torreya* for April. The sporophores grew on an old log of *Pinus resinosa* found on the shore of Lake Superior.

D. C. Babcock, in a bulletin of the Ohio Experiment Station, gives popular descriptions and suggestions for control of a number of common diseases of forest and shade trees found in Ohio.

It is said that rose leaf-blotch, caused by *Actinonema Rosae,* may be prevented by repeated spraying with lime-sulphur solution, beginning before the buds open in the spring and repeating at intervals of ten days throughout the growing season, except when the roses are in bloom.

The gladiolus is subject to a hard-rot disease due to *Septoria Gladioli,* which affects both the leaves and the corms. Crop rotation and the burning of affected leaves in the autumn are suggested by L. M. Massey as means of partial control.

Professor John Dearness, of London, Canada, has been studying fresh specimens of *Clitopilus irregularis* Peck, a species described from his locality, and finds nothing to distinguish it from *Lepista tarda* (Peck) Murrill.

Professor H. L. Wells, of Yale University, collected a specimen of *Morchella crassipes* at New Haven in June which was about a foot high with a stipe as large as a man's arm. It was preserved in formalin and deposited at the Connecticut Agricultural Experiment Station.

The February number of *The Botanical Magazine*, published at Tokio, Japan, contains an article by Professor A. Yasuda on the Thelephoraceae, Hydnaceae, and Polyporaceae of Japan. Each number of this magazine has notes on fungi contributed by Professor Yasuda.

N. A. Naumov has made an extensive study of "intoxicating bread" and states that this disease of cereals is due to *Fusarium roseum* and *F. subulatum*. The mycelium will retain its vitality in infected grain stored under ordinary conditions for about three years, but is killed in a day by dry heat at 60° C.

A. A. Jaczewski describes about thirty fungous and bacterial diseases affecting the clover plant in Russia, two of them, *Fusarium Trifolii* and *Oedocephalum anthophilum*, being new. The latter causes a mold of the blossoms such as is seen in some roses, especially in the "Soleil d'Or."

The *Proceedings of the Indiana Academy of Sciences* for 1914 contains an article by C. E. O'Neal on some species of *Nummularia* common in Indiana; and one by G. B. Ramsey on the species of *Rosellinia* in Indiana, with a brief account of the 8 species of this genus said to be parasitic.

Bulletin 380 of the United States Department of Agriculture, by C. L. Shear and others, discusses the taxonomy, morphology, and physiology of the chestnut canker fungus and related species. It is stated that the fungus causing the chestnut canker is actively parasitic only on the chestnut, but occurs also on maple, hickory, oak, and sumac.

The *American Journal of Botany* for April contains a valuable illustrated article by A. W. Blizzard on the development of some species of agarics. The species investigated are: *Omphalia chrysophylla, Clitocybe adirondackensis, Clitocybe cerussata,* and *Clitopilus noveboracensis.*

In connection with the series of articles on Japanese fungi now appearing in *Mycologia,* it may be said that Dr. Tanaka always translates the explanation of the figures and in case some mycologist should wish to study the illustrations in the original Japanese article he would be glad to furnish him with a typewritten copy of the translation of the explanation of the figures.

Dr. Charles Horton Peck, former state botanist of New York, died at his home in Albany on July 11. Dr. Peck's official term of scientific service began in 1867, and extended over a period of forty-six years. He retired on account of illness and age in 1913, and at the time of his death was in his eighty-fifth year.

Dr. John A. Elliott, associate plant pathologist of the Delaware College Experiment Station, has been elected plant pathologist of the Arkansas Agricultural Experiment Station, to fill the vacancy created by the resignation of Professor J. Lee Hewitt, who has become secretary and chief inspector of the Arkansas State Plant Board.

Charles Fuller Baker, professor of agronomy in the college of agriculture of the University of the Philippines, has been

given a year's leave of absence, to accept under temporary appointment the post of assistant director of the Botanical Gardens at Singapore, in charge of experimental work in tropical agronomy.

Dr. L. H. Pennington, of the college of forestry of Syracuse University, has been put in charge of the white-pine blister rust survey for the State of Michigan, as the representative of the Bureau of Plant Industry. His headquarters, when not in the field, are at the department of botany, Michigan Agricultural College, East Lansing, Mich.

The University of Nebraska has conferred the doctorate of science degree on Patrick Joseph O'Gara, chief in charge of agricultural and smelter waste investigations for the American Smelting and Refining Company at Salt Lake City. For the past four years Dr. O'Gara has been making extensive investigations on the effects of gaseous and solid smelter wastes on vegetable and animal life.

Bulletin 510 of the United States Department of Agriculture, by C. J. Humphrey, deals with timber storage conditions in the eastern and southern states with reference to decay problems. The author discusses present conditions and methods of improving them; he also mentions and briefly describes a number of fungi that attack stored timber. The bulletin is an exceedingly valuable one, consisting of 43 pages and 41 figures.

A new manual of fruit diseases has just appeared.* This book treats the principal fungous diseases of garden and orchard fruits, the hosts, for convenience, being taken up in alphabetical order and the diseases in the order of their importance. This is the first attempt in America to group together in one volume all the available information on this subject and to put it in such form that it is readily available and understandable to the prac-

* Manual of Fruit Diseases by Lex R. Hestler and Herbert Hice Whetzel. Pp. i–xx + 1–462 with 126 figures. The Macmillan Company, price $2.00.

tical fruit grower. This text contains a detailed discussion of the cause of each disease so far as known so that the grower will not only be able to treat the disease properly but to understand why he is applying the remedy. So far as possible, the work is based on the practical experience of the authors of the book. F. J. S.

Technical Publication 8 of the New York State College of Forestry at Syracuse is a bulletin of 50 pages and 6 plates devoted to a discussion of the black zones formed by wood-destroying fungi. The author, Mr. A. S. Rhoads, does not claim to have fully solved this problem but he gives an interesting review of the literature and adds a number of results from his own investigations. The black zones are due to decomposition products formed in the decay of the wood, which infiltrate the cell walls to a greater or less extent, frequently becoming so abundant as to form numerous brown drops within the cells. The formation of these decomposition products is dependent mainly upon the concurrence of three factors: the presence of dead cells, an optimum supply of moisture, and a supply of oxygen sufficient to promote oxidation.

THE RUSTY-SPORED AGARICS

Volume 10, part 3, of *North American Flora*, by William A. Murrill, appeared June 25, 1917. The contents of this part may be indicated, as follows:

Genera	Total North American Species	New Species
Tapinia	2	
Paxillus	2	
Crepidotus	46	7
Tubaria	14	4
Galerula	33	8
Naucoria	65	21
Pluteolus	15	4
Mycena	12	2
Phylloporus	1	
Gymnopilus	85	13
Hebeloma	49	17
	324	76

For the accommodation of those preferring currently accepted names, the following new combinations are proposed for species described as new in *Galerula, Mycena,* and *Gymnopilus:*

GALERULA PARVULA	= **Galera parvula**
GALERULA CONIFERARUM	= **Galera coniferarum**
GALERULA GLABRA	= **Galera glabra**
GALERULA HEMISPHAERICA	= **Galera hemisphaerica**
GALERULA LIGNICOLA	= **Galera lignicola**
GALERULA DISTANTIFOLIA	= **Galera distantifolia**
GALERULA REFLEXA	= **Galera reflexa**
GALERULA MEXICANA	= **Galera mexicana**
MYCENA FLAVA	= **Bolbitius flavus**
MYCENA BRUNNEIDISCA	= **Bolbitius brunneidiscus**
GYMNOPILUS ALABAMENSIS	= **Flammula alabamensis**
GYMNOPILUS FIBRILLOSIPES	= **Flammula fibrillosipes**
GYMNOPILUS CASTANEUS	= **Flammula castanea**
GYMNOPILUS SQUAMULOSUS	= **Flammula squamulosa**
GYMNOPILUS FAGICOLA	= **Flammula fagicola**
GYMNOPILUS FLAVIDELLUS	= **Flammula flavidella**
GYMNOPILUS UNICOLOR	= **Flammula unicolor**
GYMNOPILUS PICEINUS	= **Flammula piceina**
GYMNOPILUS AROMATICUS	= **Flammula aromatica**
GYMNOPILUS LUDOVICIANUS	= **Flammula ludoviciana**
GYMNOPILUS ABRAMSII	= **Flammula Abramsii**
GYMNOPILUS LONGISPORUS	= **Flammula longispora**
GYMNOPILUS OREGONENSIS	= **Flammula oregonensis**

One species of *Hebeloma,* which had to be omitted from this part, is described, as follows:

Hebeloma cubense Murrill, sp. nov.

Pileus fleshy, convex, gregarious, 2 cm. broad; surface floccose with the remains of the veil, not striate, chestnut-brown; lamellae short-decurrent, crowded, broad, cinnamon, eroded on the edges; spores ellipsoid, regular, smooth, melleous under the microscope, $11–12 \times 7–8\,\mu$; stipe flexuous, tough, fibrous, cylindric, floccose-fibrillose, pale-brown, solid, whitened below, 4 cm. long, 3–4 mm. thick; veil white, floccose, appendiculate.

Type collected on soil in a garden at Herradura, Cuba, June 15, 1907, *F. S. Earle 560* (herb. N. Y. Bot. Gard.).

W. A. MURRILL.

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THREE DOLLARS A YEAR

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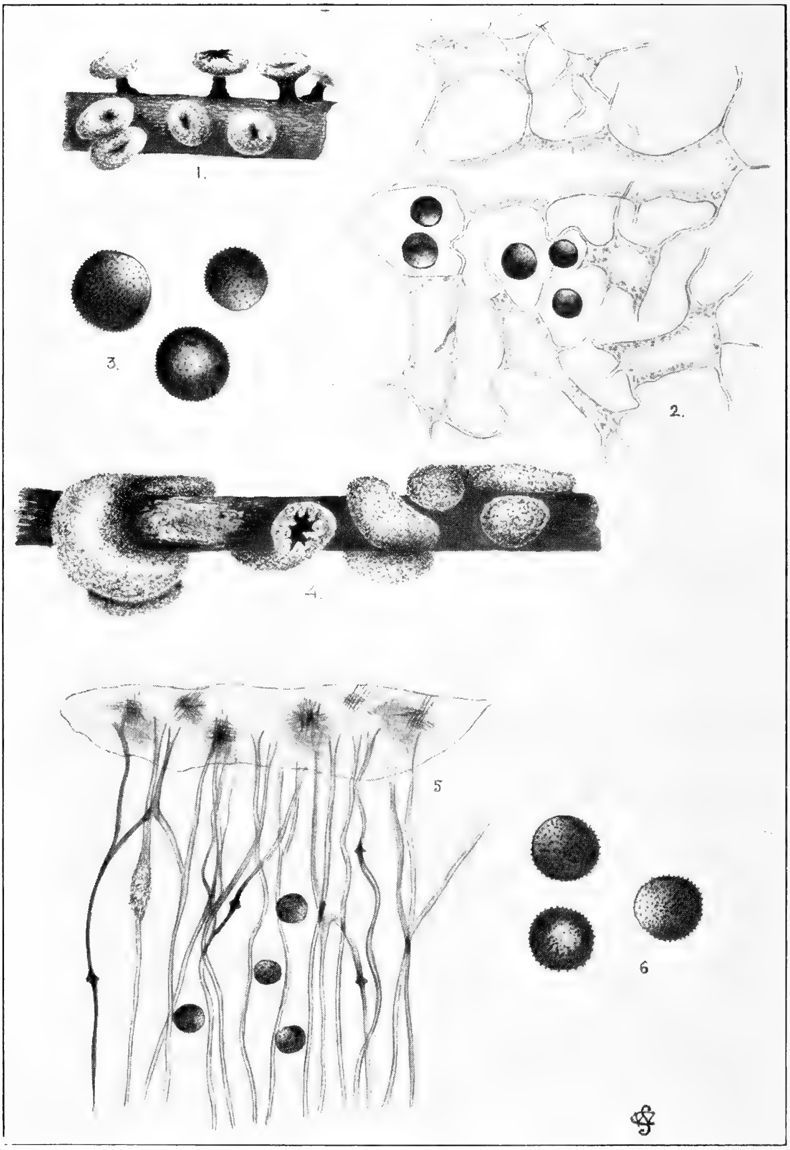

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MYCOLOGIA

Vol. IX November, 1917 No. 6

NOTES ON NEW OR RARE MYXOMYCETES

W. C. Sturgis

(With Plates 14 and 15)

During the past few years a number of interesting species of Myxomycetes have come to my attention. They are principally the result of my own collecting, but in some cases they are gatherings submitted to me through the courtesy of other collectors. In the former case most of the gatherings were made in Colorado, and add considerably to the already rich list of Myxomycetes recorded from that locality. As usual, I am greatly indebted to the expert judgment of Miss G. Lister and Professor T. H. Macbride, to whom have been submitted the more critical specimens included in the following list.

Physarum melanospermum sp. nov. *Pl. 14, f. 1–3.* Plasmodium? Sporangia stalked, gregarious or scattered, turbinate or discoid, usually umbilicate above, 0.4–0.7 mm. in diameter, grayish-white, rugose; sporangium-wall membranous, roughened above with abundant deposits of white lime, darker and reddish-brown where it merges into the stalk. Stalk stout, black, furrowed, expanding below, about 0.2 mm. long and 0.1 mm. thick. Capillitium consisting of abundant rounded, elongate or angular, white lime-knots, connected by many delicate hyaline threads. Spores dark-purplish-brown, closely spinulose, showing a paler and smoother germinal area, 12.5–16 μ in diameter.

Habitat: On dead twigs and leaves of *Clematis, Symphoricarpos,* etc., Aurora, Colorado (Bethel), Colorado Springs, Colorado (Sturgis).

This species has occurred abundantly in successive years on fallen refuse under shrubby thickets. It somewhat resembles

[Mycologia for September (9: 257–322) was issued September 24, 1917.]

small forms of *Badhamia macrocarpa,* and might be mistaken at first sight for *B. orbiculata;* but the character of the capillitium is distinctly that of *Physarum.* From *P. compressum* and *P. connatum,* its nearest allies, it may be distinguished by the shape and habit of the sporangia and their small size, as well as by the larger spores with the wall of uneven thickness.

Physarum lilacinum Sturgis & Bilgram sp. nov. Plasmodium? Sporangia gregarious, stalked, globose, erect, pale-lilac to pale-Indian-red[1] in color, 0.5 mm. in diameter; sporangium-wall membranous, beset with rounded masses of lilac or reddish lime. Stalk erect, broad-based, tapering upward, calcareous, furrowed, paler than the sporangium or concolorous, 0.7–0.9 mm. long, about 0.1 mm. thick. Columella conical or columnar. Capillitium delicate, rigid, persistent; lime-knots small, rounded, composed of large, pale lilac, or reddish, spherical granules. Spores pale-brown, almost smooth, 8–9 μ in diameter.

Habitat: On dead wood and moss. Fairmount Park, Philadelphia, Pa. (H. Bilgram).

This peculiar form occurred in considerable abundance in September, 1910, and again two years later at a distance of twenty miles from the original locality. Like *P. citrinum, P. murinum* and others of this group, it resembles *P. globuliferum* very closely, except in color. Whether this affords sufficient grounds of distinction may be questionable, but since it is at present accepted as such, it seems advisable to publish the above as a distinct species rather than as a colored variety of *P. globuliferum.* From *P. pulcherrimum* it differs not only in color, but in the shape of the columella and in the color of the spores.

PHYSARUM JAVANICUM Racib. This species occurs in a large collection of Myxomycetes made in Florida by Professor Roland Thaxter in the autumn of 1897. The scattered, stalked, white sporangia, obconic in shape, deeply umbilicate above; the subulate, spirally-twisted, sulcate stalks encrusted with whitish lime; the capillitium of large, angular or rounded, white lime-knots, with stiff, rod-like attachments to the wall, seemed to be characters applicable only to this species. Specimens were submitted to Miss Lister, who confirmed the diagnosis. This is the first record of the occurrence of *P. javanicum* outside of Java.

[1] The colors are those designated as "purple madder" and "Indian red" of Winsor and Newton's "Specimen Tints."

PHYSARUM SULPHUREUM Albert. & Schw. Syn. *P. variabile* Rex. During the summer of 1914 a species of *Physarum* occurred abundantly on dead twigs and leaves in a swamp in the Wet Mountain Valley, Colorado. Some of the gatherings showed the greenish or bronze-yellow, globose or somewhat clavate sporangia, and the reddish-brown, densely calcareous stalks of *P. variabile*. Others agreed perfectly with the original description and figure of *P. sulphureum*. This led to a careful study of the two, with the result that it proved impossible to discover any essential differences between them. The points of difference noted by the Listers (Mon. Mycet., Ed. 2, pp. 46–47) emphasize the marked similarity. Macbride (N. A. Slime-Moulds, pp. 39–40) gives an admirable description of *P. variabile*—though placing it among the forms with non-calcareous stalks—but makes no mention of *P. sulphureum*. In a recent letter, Miss Lister states that in her opinion the Colorado gatherings prove the identity of the two so-called species, and at the same time she calls my attention to a minor point of similarity between them in the form of small, greenish, spherical bodies which become apparent in the wall and lime-knots, after the lime is dissolved out with acid. In the Colorado material sessile and plasmodiocarp forms frequently occur.

PHYSARUM CARNEUM List. and Stur. This rare species, first described from material collected near Colorado Springs in 1908, was found again in the Wet Mountain Valley, Colorado, in August, 1914. It is satisfactory to note that this second gathering, occurring many miles from the original locality, wholly confirms the original diagnosis in the tawny sporangia borne on delicate, buff, limeless stalks; large, branching, white lime-knots; and bright-brownish-purple, spinulose spores, paler and smoother on one side. The original gathering was on decayed wood, the later one on a dry Basidiomycetous fungus.

PHYSARUM FULVUM (Macbr.) List. This species has heretofore been represented with certainty by only the single gathering made by Mr. Bethel, of Denver, in Loveland Pass, Colorado, in 1896. This occurred on living willow at the edge of melting snow. In August, 1915, I found it growing in limited quantity on dead coniferous wood near Lake Eldora, Colorado. Notwith-

standing an exceptionally dry summer, the specimen was badly weathered, indicating that it is a typically spring species. It is, however, perfectly characteristic in the membranous hypothallus and stalk; persistent capillitium of fine, branching threads with large, scattered, yellow lime-knots; and dark, spinulose spores, 10.5–11 μ in diameter.

CRATERIUM AUREUM (Schum.) Rost. This species is recorded here merely as an addition to previously published lists of Colorado Myxomycetes. It occurred in considerable abundance on dead herbaceous refuse in the Wet Mountain Valley and on dead twigs on Cheyenne Mountain in August, 1914. Both gatherings are of the form with globose, golden-yellow sporangia, cartilaginous below; orange stalks rising from a membranous hypothallus; dense capillitium, the nearly white lime-knots often merging into a central mass; spores 8–9.5 μ in diameter. In this form it is hardly distinguishable from *Physarum citrinellum* Pk.

CRATERIUM PARAGUAYENSE (Speg.) List. Recorded hitherto in the United States only from Louisiana (*Craterium rubescens* Rex), this species occurs in fine condition in a large collection of Myxomycetes made by Professor Thaxter in Florida in 1897. The specimens were found on dead leaves at Palm Beach and are typical in every respect.

DIDERMA TREVELYANI (Grev.) Fries. The normal form of this species is common in Colorado. In September, 1915, a plasmodiocarpic form was found in company with the normal form on dead leaves on Cheyenne Mountain, Colorado. The plasmodiocarps are of very variable form and size and of a uniform chocolate color without paler lines of dehiscence. In other respects they are quite typical.

DIDERMA RUGOSUM (Rex) Macbr. Fine specimens of this rather uncommon species were collected in Florida by Professor Thaxter in 1897. It is typical in every respect, except that the spores measure 11.5–14.5 μ in diameter, a fact of interest in view of the close relationship of this species to *D. radiatum*.

DIDERMA SIMPLEX (Schroet.) List. Miss Lister reports this species from New Jersey (Monog. Mycet., p. 108); Mr. Hugo Bilgram has collected it near Philadelphia. A very fine gathering was made by Professor Thaxter at Cranberry, N. C., in

August, 1896. The latter consists of densely crowded sporangia of a tawny color nearly approaching pale-raw-umber. The wall is somewhat cartilaginous and the spores are rather larger than in typical *C. simplex,* but the general characteristics are those of that species. Many of the sporangia show a peculiar large, hollow columella, agreeing in this particular with the specimen from Bartlett Mountain, N. H., referred to in Lister's Monograph, Ed. 2, p. 108. If this latter specimen is correctly referred to *D. simplex,* that species would appear to be subject to considerable variations in color and to be fairly widely distributed throughout the United States.

DIACHAEA CYLINDRICA Bilgr. This species, hitherto recorded only from Philadelphia, occurs in a collection of Myxomycetes made by Professor Thaxter at Intervale, N. H., in September, 1901. In its densly crowded habit it resembles *D. caespitosa;* the sporangia are also less markedly cylindric than in the type; but on the whole the specimen is evidently a form of *D. cylindrica* in which the almost confluent character of the sporangia is correlated with a remarkably indefinite and ill-developed columella.

Didymium fulvum sp. nov. *Pl. 14, f. 4–6.* Sporangia gregarious, sessile, elongate or forming curved plasmodiocarps, sometimes confluent, rarely subglobose, concave beneath, pale-raw-umber in color, 0.5–0.8 mm. in diameter, occasionally seated on a concolorous, membranous, lime-encrusted hypothallus which may form pseudo-stalks; sporangium-wall membranous, stained with yellow blotches, thickly sprinkled with clusters of large acicular crystals of pale-yellowish lime. Columella very much flattened or obsolete. Capillitium an abundant network of delicate, almost straight or flexuose, pale-purple or nearly hyaline threads, frequently with dark, calyciform thickenings as in *Mucilago,* and occasionally showing fusiform, crystalline blisters. Spores dark-purplish-brown, coarsely tuberculate, the tubercles usually arranged in curved lines, paler and smoother on one side, 12.5 to 14.5 μ in diameter.

HABITAT: On dead twigs, leaves and other refuse. Wet Mountain Valley, Colorado, August, 1913.

This peculiar form has been found only once, but in considerable abundance. At first sight it bears a very close resemblance to some form of *Lepidoderma Carestianum,* but notwithstanding

the variable character of that species it could hardly be made to include a form with stellate lime-crystals. The capillitium and spores resemble those of *Mucilago,* but it is evidently removed from that genus by its habit and structure. Among the species of *Didymium,* the only one approaching it in color appears to be *D. leoninum,* but otherwise the two forms have no features in common. On the whole, the present species appears to stand by itself in the genus *Didymium,* but with decided leanings toward *Lepidoderma,* and even toward *Mucilago.*

ECHINOSTELIUM MINUTUM DeBary. This species occurred on dead herbaceous stems in a laboratory culture in Professor Thaxter's laboratory at Cambridge, Mass., in December, 1914. The material came from Waverly, Mass. Although this appears to be the first record of its appearance in America, the species may not be uncommon. Its small size and its resemblance to a *Mucor* or some Hyphomycetous fungus might easily cause it to be overlooked.[2]

AMAUROCHAETE FULIGINOSA (Sow.) Macbr. This species has been reported hitherto in the United States only from New England, New York, Carolina, and Ohio. In 1909, Mr. Bethel collected it on dead wood of *Pinus Murrayana* at Tolland, Colorado, thus extending its range westward.

In the Cryptogamic Herbarium of Harvard University there is a specimen from Professor Macbride marked "*Amaurochaete cribrosa* (Fr.)," collected on Mt. Rainier, Washington. It is very different from *A. fuliginosa,* consisting of a round, determinate, sooty patch of ill-developed sporangia showing weak, indefinite, membranous columellae and a capillitium composed of very delicate, more or less arcuate threads connecting angular or elongated membranous expansions, the whole forming a very open and imperfect net with many free ends. The spores are rather dark, minutely spinulose, paler and smoother on one side, and measure 12–15 μ in diameter. They are slightly larger and darker than those of *A. fuliginosa.* A precisely similar form was collected by Mr. A. P. D. Piguet at Sharon, Mass., in May, 1910, on bark of *Pinus Strobus.*

[2] Since writing the above, a gathering of *Echinostelium* has been reported to me by Mr. Bilgram, of Philadelphia, who found it growing in the open, in company with *Tilmadoche.*

That this is the "*Lachnobolus cribrosus*" of Fries appears to me fairly certain, and with this view both Miss Lister and Professor Macbride agree. The combination, *Amaurochaete cribrosa* (Fr.) appears never to have been published.

CRIBRARIA TENELLA Schrad. Specimens of this common species were found in December, 1898, at Palm Beach, Florida, by Professor Thaxter. They are noteworthy as being the "very small neat variety" noted by Miss Lister (Mon. Mycet., Ed. 2, p. 181) as occurring in this country and in Dominica. The variety bears a very close resemblance, except in color, to *C. microcarpa*.

CRIBRARIA VIOLACEA Rex. A rather abnormal form of this species was found by Professor Thaxter on pig-dung and on wood at Eustis and Cocoanut Grove, Florida, in September and November, 1897. In both gatherings the apical portion of the sporangia consists of large polygonal, membranous fragments, connected by many very delicate threads. Only occasionally are any thickened nodes apparent.

CRIBRARIA PURPUREA Schrad. This rare species occurred in considerable abundance on coniferous wood in the Wet Mountain Valley, Colorado, in August, 1913. It was collected as *Dictydium*, its true character appearing only upon microscopic examination. From *C. elegans* Berk. & Curt., it differs in its larger size, the surface-net with variously expanded nodes, and the minutely spinulose spores. These characters, however, are not altogether distinctive; the present gathering shows a certain blending of the two, and it is not unlikely that further gatherings of *C. elegans* may show that it is only a small form of *C. purpurea*.

Enteridium minutum sp. nov. *Pl. 15*. Plasmodium? Aethalia rounded or elongate, pulvinate, pale umber in color, seated on a broad membranous base, 1.5–2 mm. in diameter; wall wrinkled and usually marked with small, scattered pits, pale-yellow, membranous. Walls of the component sporangia membranous, minutely roughened, perforated with round openings, the margins of which show many free threads; or reduced to irregular, anastomosing strands arising from the base of the aethalium, with membranous or net-like expansions at the angles and with many delicate, free, pointed ends. Spores pale-yellow, usually united in twos or threes and ovoid or flattened on one side; when free, globose, very minutely spinulose, 9.5–10.5 μ in diameter.

HABITAT: On dead coniferous wood. Eldora Lake, Colorado, August, 1915.

It is with great hesitation that I describe this form as a new species. Miss Lister states, in correspondence, that the aethalia of *Enteridium olivaceum* are frequently very small, but the spores of that species are always olive in the mass, in sharp contrast with the yellow color seen in the form under discussion; apparently also, they are always united in large clusters. The inner structure of the aethalia of *E. minutum* is in some cases almost exactly that of typical *Enteridium;* in others it more nearly resembles the capillitium of *Liceopsis;* yet the aethalia show every indication of having developed normally to maturity. On the whole, it has seemed best to record this form now, in the event of further gatherings being made which may throw additional light upon it.

HEMITRICHIA LEIOCARPA (Cke.) List. About two years ago Mr. Bilgram of Philadelphia sent me a specimen which bore a certain resemblance to a long-stalked form of *Arcyria cinerea*. Upon closer examination, however, it proved to be *Hemitrichia leiocarpa*. It is in all respects typical and appears to differ quite markedly from *H. clavata* in color and in the small size of the spores. An interesting feature of the gathering, to which Miss Lister called my attention, is seen in the right-handed spirals on the capillitial threads; while in *H. clavata* the spirals are left-handed. Miss Lister further states, in correspondence, that in the type specimen of *H. leiocarpa* from Maine, as well as in a specimen collected by Professor Balfour in the Edinburgh Botanic Gardens, the spirals are right-handed, while in the type of *H. Varneyi* Rex, which is supposed to be identical with *H. leiocarpa,* the spirals are left-handed, as in *H. clavata,* and she suggests that the direction of the spirals may be diagnostic. In my opinion this is probably not the case. It is not unusual in the case of *Arcyria globosa,* for example, to find specimens in which the minute spines on the threads are arranged in a right-handed spiral, though normally the arrangement is left-handed, as noted by Miss Lister (Mon. Mycet. Ed. 2, p. 238). Such is the case in the specimen distributed by Ellis & Everhart in N. Am. Fungi *1116*. If the spirals in *H. leiocarpa* may be either right-handed

or left-handed, the species has now been recorded from Maine, Kansas, Pennsylvania, Poland and Scotland.

ARCYRIA OERSTEDTII Rost. A single large gathering of this species was made in the Wet Mountain Valley, Colorado, in August, 1914. It is perfectly characteristic, though lacking the persistent remnants of the sporangium-wall. This is not a diagnostic feature. The species is recorded from New York, Pennsylvania, and Kansas. The present record extends the range westward, making it probable that it is not uncommon throughout the United States.

ARCYRIA OCCIDENTALIS (Macbr.) List. This rare form was found at Oquossoc, Maine, growing in company with *Trichia contorta* on poplar bark, in May, 1916. The gathering is faded and weathered, indicating that the species should be looked for early in the spring or possibly in the late autumn. The sporangia are either separate or crowded; in the former case they show fairly long stalks. The persistent portion of the wall splits downward in rounded lobes. The minutely spinulose capillitium is marked besides with a single row of small blunt teeth, arranged in a very open spiral. Though rare, the species appears to be widely distributed.

PERICHAENA CORTICALIS (Batsch) Rost. var. *liceoides* (Rost.) List. In looking over a collection of Myxomycetes made by Professor Thaxter in Florida in 1897, I came across a peculiar form growing on cow-dung, which, from its minute size, its delicate, membranous structure, and the complete absence of capillitium, I took to be an undescribed species of *Licea*. Specimens were submitted to Miss Lister, however, who, in reply, referred the gathering as above, stating further that in a series of specimens, all on dung, the capillitium was either absent, or in the form of irregular elaters, or even combined into a net. In the Florida specimens the sporangia are globose or pulvinate, sessile, yellow-brown, 0.14–0.29 mm. in diameter; the wall is pale-yellow, membranous, with minute granular thickenings; capillitium wanting; spores yellow, thick-walled, distinctly spinulose, 11.5–13.5 μ in diameter. This is the first recorded gathering in America.

DIANEMA HARVEYI Rex. This species has hitherto been repre-

sented in America only by Harvey's original gathering from Orono, Maine. It is therefore satisfactory to be able to record another locality. In August, 1913, it was collected in small quantity in the Wet Mountain Valley, Colorado. The gathering corresponds in every particular with the original description.

DIANEMA CORTICATUM List. A small gathering of this interesting species was made at Lake Eldora, Colorado, in August, 1915. The salmon-pink plasmodium occurred on coniferous wood and was seen to mature into subglobose or elongated, crowded sporangia, often longitudinally wrinkled and of a reddish-brown or chestnut color. The capillitial threads are scanty, delicate, straight, rarely branching, often thickened longitudinally or in a bead-like manner, rarely showing traces of spiral markings. The spores, usually united in clusters of 2–5, are, in the mass, precisely the color of those of *Lycogala epidendrum*. This is the first record of this species in the United States. Miss Lister writes me that it was collected by Professor J. W. Eastham near Quebec in September, 1913. In gross appearance and in the character of the sporangium-wall, *Dianema corticatum* recalls the genus *Perichaena*. The clustered, yellow spores are similar to those of *Enteridium*. The capillitium exhibits the features of both *Prototrichia* and *Dianema*. As Miss Lister points out, it is undoubtedly a transition form connecting the two latter genera.

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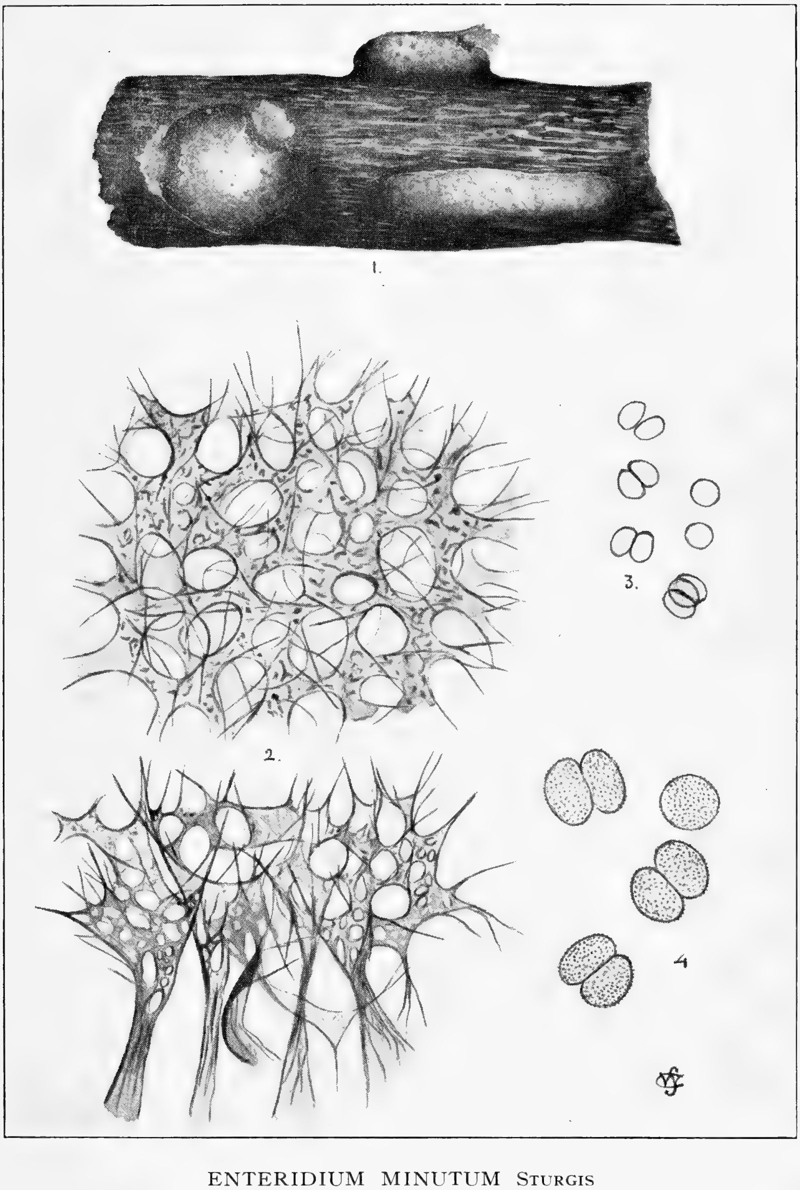
EXPLANATION OF PLATES

PLATE 14

Fig. 1. *Physarum melanospermum*. Habit. × 15.
Fig. 2. The same. Capillitium and spores. × 450.
Fig. 3. The same. Spores. × 960.
Fig. 4. *Didymium fulvum*. Habit. × 15.
Fig. 5. The same. Portion of sporangium-wall, with capillitium and spores. × 450.
Fig. 6. The same. Spores. × 960.

PLATE 15

Fig. 1. *Enteridium minutum*. Habit. × 15.
Fig. 2. The same. Portions of interior of aethalia showing varied structure of component sporangium-walls. × 450.
Fig. 3. The same. Spores. × 450.
Fig. 4. The same. Spores. × 960.



ENTERIDIUM MINUTUM Sturgis

STUDIES OF THE SCHWEINITZ COLLECTIONS OF FUNGI—II

DISTRIBUTION AND PREVIOUS STUDIES OF AUTHENTIC SPECIMENS

C. L. Shear and Neil E. Stevens

Schweinitz is known to have given autograph specimens of fungi to no less than fourteen individuals and herbaria.[1] So far as the writers have been able to determine, the specimens sent to Halsey are no longer extant. The herbarium of Zeyher is said by de Candolle (7, p. 461) to be in the museum of the Grand Duke at Carlsruhe. This collection the writers have not examined and it is uncertain whether the Schweinitz specimens of fungi are there. Only a few of the specimens given to Schwaegrichen have been found, one having been seen in the herbarium at Strasburg, and a few in Kunze's collection in the herbarium of the University of Leipzic.

Other collections of fungi distributed by Schweinitz during his lifetime are preserved in the following herbaria: Kew, specimens sent to Torrey and Hooker; Upsala, herbarium of Fries; Academy of Natural Sciences, Philadelphia, Collins collection; Royal Botanic Garden, Edinburgh, herbarium of Greville; Paris Museum, herbarium of Brongniart; Vienna, herbarium of Jacquin; Berlin, herbaria of Link and Ehrenberg; Strasburg, herbarium of Nees von Esenbeck; Leipzic, herbarium of Kunze.

At his death in 1834, Schweinitz's herbarium was left to the Academy of Natural Sciences, Philadelphia. The Academy recognized the importance of this accession and a short time later published the biographical sketch of Schweinitz by Johnson which has been referred to in the preceding paper. The manner in which the specimens of fungi were arranged at the time they were transfered to the Academy, as well as the manner in which

[1] Studies of the Schweinitz Collections of Fungi—I. Sketch of his Mycological Work. Mycologia 4: 191. 1917.

the greater portion of them were subsequently rearranged and mounted has been already described and illustrated by the writers (41, pp. 6–11, pls. 3, 4, 5, 6).

When the former paper was prepared it was apparent that the greater part of the work of rearranging the specimens was done by Dr. Ezra Michener. No evidence could, however, be obtained as to the date at which this work was done. Nor was it clear whether the specimens were rearranged and mounted before or after the studies of Berkeley and Curtis. Realizing the importance of this information the writers have endeavored to obtain further data by correspondence with various people in this country and in England, and recently (December, 1916) have made a thorough search for possible manuscripts which might throw light on the question.

Fortunately, letters preserved in the files of the Academy of Natural Sciences at Philadelphia, which through the courtesy of Doctor Nolan the writers were permitted to examine, enabled them to settle these doubtful points. The early correspondence of the Academy is rather fragmentary, due to the fact that until about twenty years ago there were no salaried officers connected with the institution to whom the care of such matters could be entrusted. About eighteen years ago Doctor Nolan caused such letters as had by chance been preserved to be filed chronologically, and in these files letters from both Curtis and Michener were found. In addition, Miss Elsie M. Wakefield, of the Cryptogamic Herbarium, Royal Botanic Garden, Kew, has generously sent the writers such information as could be obtained from the letters of Curtis to Berkeley, preserved at the British Museum.

From these sources the writers have been able to learn the dates at which Curtis and Michener worked on the Schweinitz herbarium and also much about the work of each. This information is given chronologically below. According to Miss Wakefield:

"The correspondence of Berkeley and Curtis began about 1845 or 1846, and from the replies given in several of Curtis' letters it would appear that Berkeley made inquiries as to the whereabouts and preservation of Schweinitz's collection, the possibility of obtaining duplicates, etc., and urged Curtis to spend some time studying them.

"Curtis at first said it was impossible for him to find time to work in the Schweinitz herbarium.

"In 1851, however, he seems to have spent some time traveling for the sake of his health. In a letter dated October 23, 1851, he mentions some places he visited, and adds: 'My greatest performance was 17 hard—desperately hard—days at work on Herb. Schwein.' At this time there seems to have been no mycologist in charge of the herbarium, and Curtis says that the authorities, knowing the collection was of value, had begun *baking* the specimens in order to destroy insects. He was in time to stop this and to start poisoning operations. He then goes on: 'By the great favour of the Curators I was permitted after much hesitation and some bargaining to take a specimen from the collection when there were more than two of any species. I thus obtained so many, that with my notes and figures I can now authenticate two thirds of Schweinitz's list, I presume. Where I can divide my specimens I will share with you. Wherever I can make three good fragments I mean to give Fries the third. I can send you 10–1,200 I guess."

Evidently Curtis carried out this intention, as the senior writer has seen specimens in the Fries herbarium labeled "Ex Herb. Schwein" in Curtis's hand.

Curiously enough no mention of Curtis's visit could be found in the Proceedings, from which it seems probable that he dealt only with the "authorities," probably the curator of the collections. Curtis's interests in the herbarium and his concern for its preservation, as well as some indication as to the conditions under which he was allowed to take specimens can be obtained from his letter dated Society Hill, S. C., May 24, 1852, and now in the files of the Academy.

"I have been informed that the species of plants from different collectors & Authors in the Herb. of the Academy are much intermingled: so that where the same species is had from two or more persons, the specimens cannot be authenticated. If this be so, it is unfortunate & wrong, & will detract greatly from the value of the collection. If possible, such a course should be prevented in future. I hope, however, this is not the case to

any great extent. In the collection of Fungi,[2] which is the only portion I examined, there is occasional confusion of this sort, which, wherever it occurred, was exceedingly vexatious to me, as it effectually prevented the authentication of the species of the several authors. This would not be a very serious evil, if the specimens were always of one species. But where they differ, the evil is irreparable. I fear that a careless haste has had a good deal to do in causing their confusion. But where there is so much to be done, so few to do it, & labor gratuitous, I suppose we cannot expect everything to be done perfectly. Nevertheless, I hope you & others will see that no further confusion is made in your large & valuable Herbarium.

. . . .

"I promised a critical review of the Fungi of Herb. Schweinitz for your Transactions, & also a collection of fungi. These will be prepared as soon as possible, but it will be some time first. Each will be more complete for delay. Please to wait upon me with all patience. I shall not forget the claims of the Academy upon me for the valuable privileges allowed me last Fall."

Shortly after the above letter was written "In a letter dated June 2, 1852," according to Miss Wakefield, "he advises the dispatch of nearly 1,500 of these duplicates of his Schweinitzian specimens. At the same time he mentions that he had promised the Philadelphia Academy a critical review, and asks Berkeley to send him his observations, so that the paper could be published in their joint names.

"Subsequent correspondence deals with the preparation of the two papers,—the one on Surinam fungi, and the 'commentary.'

"Early in 1855 Curtis also sent to Berkeley, for his examination, a parcel of mounted specimens from Herb. Schwein. ('over 300, I believe') which were to be returned when done with, as they were such as could not be divided. There is nothing to indicate whether these were all the remaining specimens in Curtis' possession, or only a part.

[2] The few instances in which such confusion occurs in Schweinitz's original packets, so far as the writers have observed, are those in which Schweinitz himself included specimens received from other collectors.

"Previous to this visit to Philadelphia, at the end of 1850 or very nearly in 1851, Curtis had also received about 200 Schweinitzian specimens from Torrey. These also he divided with Berkeley where possible. Evidently therefore Berkeley never saw the whole of Schweinitz's collection."

Curtis's interest in the herbarium and his concern about its state of preservation seems to have resulted in greater care on the part of the authorities. At any rate in the report of the curators for 1851, the year of his visit, mention is made of the necessity of more carefully guarding the collections.

In the report of the curators for 1855, (1) appears this brief entry: "The herbarium of phanerogamous plants is now undergoing careful rearrangement by Mr. E. Durand; and several of the members intend shortly to rearrange the collection of cryptogamia." Although Dr. Michener is not mentioned, it is certain that at this time he had been selected to rearrange the fungi, as indicated by the following note preserved in the files of the Academy:

"Will T. P. James please say to Dr. Zantzinger when convenient that would like him to see and send on the first order (Hymenomycetes) of Schweinitz Fungi with portfolios paper etc. whenever he can get them ready

"and oblige

"31 of 8 mo 1855" "E. Michener."

The first package of fungi was apparently sent to Dr. Michener late in 1855, for early in the following year he wrote the botanical committee of the Academy of Natural Sciences[3] concerning the problems connected with their rearrangement. In this letter Michener speaks of the poor condition of many of the specimens and the fact that many of them had been destroyed by insects or had otherwise disappeared.

Subsequent letters from Michener to Dr. Zantzinger and to Dr. Meigs, of the Academy, indicate that Michener worked on the fungi at his home in New Garden, Pa., during this and the following winters. For in a letter dated 18th of 3d mo. 1857 he speaks of desiring "the balance of the herbarium." The material was evidently sent to him in several different lots by way

[3] Letter in the files of the Academy dated "New Garden 16 of 1 mo 1856."

of Wilmington, the paper on which the fungi were mounted being furnished by the Academy.

The manner in which Michener mounted the herbarium has been described and illustrated by the writers in another connection (41). It should be noted, however, that in transcribing the labels Michener sometimes did not include all the data given by Schweinitz. For example, the autograph label on the empty packet of *Sphaeria intermedia* L. v. S. says "Bethl in Crataego." The host is not given on the label in the mounted collection.

From the data which the writers have been able to gather it now seems certain that Berkeley never saw the whole of Schweinitz's collection. His work was based on material from three sources, the specimens sent by Schweinitz himself to Dr. Hooker, referred to above, specimens which Schweinitz gave Torrey who sent them to Curtis, and the specimens which Curtis obtained from the herbarium of the Academy of Natural Sciences in the fall of 1851. The greater portion of the specimens which Curtis had he divided with Berkeley and these are now deposited at Kew.

In the published work of Berkeley and Curtis (4), there is no indication as to the source of the particular specimen examined. But in Berkeley's personal copy of the "Synopsis Fungorum in America Boreali" (40), now in the library of the U. S. Department of Agriculture, many of the species are checked in pencil with a small mark $\checkmark$, "C," "H," or with two of these symbols. This the writers take to indicate the source of the specimen, whether from the Hooker collection, loaned by Curtis, or a part of Berkeley's own herbarium. For example, *Sphaeria radicalis* is marked "C" and "H" and there are specimens of this species in Hooker's herbarium and in the Curtis herbarium at Harvard; while *S. gyrosa* is marked "H" and a specimen has been found in Hooker's herbarium. In the early part of the book the species checked are chiefly those on which comment is made in the "Commentary on the Synopsis Fungorum in America Boreali media degentium, by L. D. de Schweinitz" but the marks occur throughout the book.

In the light of the fact that Curtis (see p. 336) sent Berkeley "about 300 specimens" to be returned later, it is of interest to

note that three hundred ten species are marked "C" in Berkeley's copy of the Synopsis Fungorum. Berkeley apparently studied microscopically the specimens which were to be returned to Curtis as in the margins over eighty habit sketches or drawings of spores with occasional notes have been made in pencil. These occur almost uniformly in connection with species marked "C."

So far as the writers have been able to learn, Curtis was the first to work with Schweinitz fungi after his death. His own herbarium then probably includes the first material taken from the Schweinitz collection. The specimens sent to Berkeley and to Fries are portions of the duplicates he took at that time. Michener's work was done a few years later and the specimens in his herbarium, which is now in the Mycological Collections of the U. S. Department of Agriculture, were evidently taken after Curtis's.

Both Curtis and Michener speak, in their letters, of numerous specimens being lacking. Schweinitz, as we stated in a letter to Torrey (Part 1, p. 194), preserved very few of the Agarics, and it is evident that insects have caused great destruction among the fleshy forms that were kept. Moreover, in some cases he apparently gave away his last specimen of some species, as (41, p. 9) when he sent his only specimen of a species of *Hypoxylon* to Schwaegrichen.

Dr. John Shaw Billings was probably the next mycologist to study material from the Schweinitz herbarium. In the introduction to his paper on the genus *Hysterium* (6) he says: "My data for this purpose are derived from the examination of authentic specimens in the Schweinitz herbarium, and in the herbarium of Mr. H. W. Ravenel of South Carolina, from specimens named by Rev. M. A. Curtis, and from the description and figures given by M. Duby in his 'Memoire sur la Tribu des Hysterinees, Geneva, 1861.'"

Mr. Wm. C. Stevenson, Jr., of Philadelphia, became interested in the Schweinitz collection of fungi, according to his recent statement, about 1872, when he was made a member of the herbarium committee of the Academy of Sciences. Mr. Stevenson's interest in mycology early led to a correspondence and exchange of specimens with Mr. J. B. Ellis, of Newfield, N. J., and to a friendship

which lasted during Mr. Ellis's life. Mr. Stevenson did a considerable amount of work on the fungi of the Schweinitz herbarium, his paper on the Valsei of the United States (44) being based on Schweinitz specimens.

In the course of his work on the fungi he to some extent rearranged the specimens and relabeled the portfolios. Stevenson's labels give the numbers of the specimens included in each portfolio, whereas the original labels as prepared by Michener simply give the names of the genera included in the cover but not the numbers. This is evident from four empty covers bearing Michener's labels still preserved in the herbarium. In relabeling the volumes Stevenson evidently placed more sheets in a cover than Michener had done, which accounts for the four empty covers left over.

Certain specimens which were indicated as missing by Stevenson on the folio labels, *i. e.*, Nos. 1493 to 1663 and Nos. 1664 to 1809, were found some years ago in two packages labeled "This package as it came from the Smithsonian Institution." The sheets containing these specimens were placed in their proper places in the portfolios by Prof. J. C. Arthur and the senior writer during a visit to the herbarium in February, 1917, and a note to that effect placed on the labels of the portfolios. This the writers take to indicate that these specimens were loaned to the Smithsonian Institution before Stevenson relabeled the portfolios. Duplicates of many of these missing specimens are in the Curtis collection at Harvard. Dr. Farlow writes that there are 32 of the 42 species of *Puccinia* mentioned in North American Fungi (40) and 28 of these species are checked in Berkeley's personal copy. The Michener collection contains specimens of 37 of Schweinitz species of *Puccinia.*

In the last volume of the fungi as now arranged Nos. 2905 to 2972 (containing *Puccinia*, etc.) also 2973 to 2997 inclusive are missing. The original packets of Schweinitz are in the collection, as are the portfolios, bearing Michener's labels, which originally contained *Puccinia* and related genera. This indicates that Michener mounted these specimens as well as the others and that they disappeared subsequent to this work. In many cases where specimens are missing in the mounted collection there are pin holes

in the sheets showing apparently that the specimens were placed there by Michener but have since been removed.

During 1885 and 1886, Dr. J. W. Eckfeldt, of Philadelphia, critically examined and arranged the lichens in the herbarium of the Philadelphia Academy of Science. At this time the type collections of Schweinitz and Tuckerman were kept separate from the others and undisturbed. A general catalogue was, however, prepared in order to facilitate reference to these collections. Dr. Eckfeldt lists 462 species as occurring in the Schweinitz collection of lichens (1, p. 342).

It is evident that Tuckerman at some time made careful study of the lichens of the Schweinitz herbarium, for in Michener's list of lichens of Chester County (36, p. 451) Tuckerman, who prepared the descriptions of new species for this list, cites, as a new species, *Endocarpon arboreum,* Schweinitz, MS., and in his North American Lichens (45, p. 148) he says, "*Cladonia cetrarioides,* Schwein. herb. (Tuck. Suppl. 1, l. c. p. 427) is still only known to me in the original specimens (from North Carolina) of Schweinitz."

Ellis's studies of fungi in the Schweinitz collections, (22, 23) were all made, according to Mr. Stevenson, at the Academy. The later paper was apparently based on fungi from the "Collins Collection," which was found in 1894 in the herbarium of the Academy of Natural Science where it "had lain unnoticed for many years."

Durand (21) in preparing his monograph of the Geoglssaceae of North America studied Schweinitz's types in the herbarium at Philadelphia.

Lloyd (35) after "several visits" to Philadelphia for the purpose of studying Schweinitz's specimens published a revision of a number of species. Lloyd's conclusions as to the material on which the work of Berkeley and Curtis was based are evidently erroneous, as shown by the correspondence cited above.

In connection with their studies of the genus *Endothia* the writers have recently published (41) a discussion of the specimens collected by Schweinitz, based partly on specimens in the Philadelphia herbarium.

Berkeley and Curtis, Billings, Stevenson, Ellis, Tuckerman,

Durand, Lloyd, and the writers, have been mentioned as having published observations based on material in the Schweinitz herbarium at Philadelphia. Several of these investigators have also examined Schweinitzian specimens in other Herbaria. Berkeley had those contained in Hooker's herbarium at Kew and specimens sent by Torrey to Curtis. Durand mentions among the herbaria in which he studied (21, p. 393) Fries's herbarium at Upsala, The Kew Herbarium, and the Curtis Herbarium at Harvard. In connection with their studies on the genus *Endothia* the writers examined specimens in the Curtis and Michener herbaria and the senior writer examined specimens in all the European herbaria in which Schweinitz's specimens are known to exist (see page 333).

Berlese (5) cites original specimens of Schweinitz sent to him from Kew by Cooke. Cooke's (8–17) studies are based on Schweinitz material in the herbarium at Kew, as are also those of Currey. Currey (18–20), however, as the titles indicate, confined his published work largely to specimens in Hooker's herbarium. In the researches of Dr. Farlow (24–28), studies of Schweinitzian material are based chiefly on the Curtis collection, now in his own herbarium at Harvard. Fries (29, 30) and Kunze (33), of course, received specimens directly from Schweinitz, but the latter also had specimens given him by Schwaegrichen (p. 333). Von Höhnel mentions (31, p. 393) having studied material from the herbaria at Berlin, Kew, Paris and Upsula, but makes few specific references (see 32, p. 356) to the source of particular specimens. Lister's (34) studies of Schweinitz's types are based on material at Kew. Nitschke (37) studied material from Kuntze's herbarium at Leipzic. Starbäck (42, 43), as the title of one of the papers indicates, based his work on material in Fries's herbarium, while the Tulasnes (46) had available the Brongniart herbarium, in Paris.

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NEW OR NOTEWORTHY NORTH AMERICAN FUNGI

John Dearness

1. **Valsa clavigera** Dearn. & Barth.

Stromata cortical, removable with the bark and leaving no discoloration on or in the subjacent wood; thickly gregarious, or subseriately arranged, pustulate, hemispheric, .75–1.5 mm., mostly 1 mm., in diam. Perithecia black, 5–15 mostly 8–11 in a stroma, circinate immediately under the epidermis, globose, .3–.4 mm., with clavate ostiola .5–.7 mm. long, 90 μ across neck, 180 μ across head, crowded, and usually obliterating the pale disk. Asci subglobose to fusoid, 27–40 μ. Sporidia conglobate to obliquely biseriate allantoid, $9 \times 2.5\ \mu$.

On dead branches of *Schizonotus discolor* (Ph.) Raf., Bremerton, Wash., July, 1912. *Bartholomew, 4782.* Type collection, Fungi Columb. *5099.*

This is different from, although near *V. opulifolia* Peck, with authentic specimens of which it has been compared.

What appears to be this species (*V. clavigera*) on fire-killed *Acer macrophyllum* Ph. in the same locality has larger stromata with more numerous perithecia. This form is distributed in Fungi Columb. *5098.*

2. **Diatrypella minutispora** sp. nov.

Stromata scattered, gregarious, or seriate, small, mostly about 1 mm. at base, nearly superficial on the cortex, not blackening the subjacent tissues, rupturing the epidermis into very narrow, often elongate clefts. Perithecia black on a brownish, expanded, basal stroma, .2 mm. but variable in size and shape, rough, shining above, truncate-conic in the best developed examples, 3 to 5 in a stroma; ostiola short, obtuse, perforate. Asci stipitate—stipe sometimes half the total length, sp. p. obtuse-fusoid, $60–75 \times 12\ \mu$;

[1] Acknowledgments for opportunity to examine type and co-type specimens or for citations of literature are due to Dr. H. D. House, Dr. R. E. Stone, Dr. F. J. Seaver, and Mr. C. G. Lloyd.

paraphyses linear, looking as though they contained a line of spores, sometimes twice as long as the asci. Sporidia innumerable, hyaline, very minute, straight or somewhat curved, 3–3.5 × .5–.7 μ.

On dead branches of *Corylus rostrata* Ait., Washington Co., N. Y., June, 1916. *S. H. Burnham, 89.*

Diaporthe tessera Fr. is mixed with it in the type material. In several particulars this agrees with the European *D. Tocciaeana* de Not., a species which Dr. Peck reported on hazel at Sandlake, N. Y.; but the latter is said to exhibit a dark circumscribing line and to have brownish sporidia, 5–7 × 1.5 μ.

3. BOTRYOSPHAERIA SUMACHI Cooke, Grevillea **15**: 80. 1887

Sphaeria Sumachi Schw., Syn. N. Am. Fungi *1425.* 1832.

Sphaeropsis Sumachi (Schw.) Cooke & Ellis.

Haplosporella Sumachi (Schw.) Ellis & Ev., N. Am. Pyrenom. 744. 1892.

Mr. S. H. Burnham's *125* on *Rhus glabra,* Warren Co., N. Y., is ascigerous—a *Botryosphaeria* whose stromata externally and in cross section are exactly like Prof. Peck's W. Albany collection on the same host labeled *Sphaeropsis Sumachi* (Schw.) Cooke & Ellis. The latter is really a *Haplosporella* consisting as it does of flat, black stromata containing 2–8 internally white pycnidia, 75–90 μ. The former shows both the brown conidia of the latter and thick-walled asci containing eight hyaline, fusoid sporidia 18–20 × 6–8 μ. It may be another of the numerous forms of *Botryosphaeria fuliginosa* (M. & N.) but the perithecia are not botryoidally aggregated and the asci and sporidia are smaller. Cfr. *Haplosporella Burnhami* sp. nov. on a subsequent page.

My copy of Fungi Columb. *1053* labelled *Sphaeropsis Sumachi* (Schw.) is not a *Haplosporella.* The spores are larger and usually contain a single large nucleus instead of the usual two nuclei of *Haplosporella Sumachi.*

4. SPHAERELLA TRICHOPHILA Karst. f. *Saxifragae*

This *Sphaerella* has characters connecting it with *S. minor* Karst. and with *S. pachyasca* Rostr. both of which inhabit *Saxi-*

fraga in Greenland. But the bristles near the vertex, the brown subiculum and the fruit characters bring it closer to *S. trichophila* Karst. The last inhabits species of *Pedicularis* in West Greenland. *Saxifraga* seems to be a new host for it. Rostrup found the sporidia on *Pedicularis* 20–25 × 6–7 µ; this has asci 45–62 × 15–16 µ and sporidia 15–18 × 5–6 µ.

On *Saxifraga Nelsoniana* D. Don., Camden Bay, northern Alaska. *F. Johansen,* Can. Arc. Exped., June, 1914.

5. **Venturia subcutanea** sp. nov.

Perithecia membranaceous, nearly black, gregarious, erumpent through or covered by the loosened cuticle, hypophyllous, attached to a subicle of septate, branching, brown fibrils, 4–20 µ thick, making orbicular spots 1–4 mm. in diameter; hardly visible on the upper side of the leaf but opaque when held to the light. Some of the perithecia bearing few to 10 short, rigid, brown bristles near the stoma, others smooth; plano-globose to conic, 90–150 µ. Asci 8-spored, aparaphysate, often broadest near the base, 54–66 × 10–15 µ, the walls 2 µ thick. Sporidia 1-septate, fuliginous, often biseriate in the lower half, 15–17 × 4.5–6 µ.

On dead leaves of *Salix reticulata* L., Kongengevik, N. Alaska, June, 1914. *F. Johansen, 63 b,* Can. Arc. Exped.

This variable species was sought in lists of *Sphaerella, Asterina* and *Venturia.* The perithecia attached to the cuticle seem to lack the bristles while those that are free from it but covered by it possess them.

6. (?)**Myrmaecium Cannae** Dearn. & Barth. sp. nov.

Stromata minute, mostly about .25 mm., largest 1 mm., scattered over the leaf, erumpent on both sides but mostly hypophyllous, blackened by the perithecia. Perithecia black, one to several in a stroma, 17 the largest number counted in one stroma, globose to truncate-conic, 90–180 µ. Ostiola short, blunt, black, shining. Asci short-stipitate, 60–90 × 6–10 µ; paraphyses linear, some of them branched. Sporidia hyaline, 1-septate, upper cell larger, 10–15 × 4–8 µ. Some of the perithecia filled with conidia and sporophores; conidia linear-oblong, obscurely 1-septate, 15 × 2.5–3 µ.

On withered leaves of *Canna Indica* L., Cabo Rojo, Porto Rico, Oct., 1912. *F. L. Stevens.* Ex herb. Bartholomew *303.* Type collection, Fungi Columb. *5038.*

7. **Diaporthe exiguestroma** sp. nov.

Stromata minute, scattered, seated in the unaltered cortex, not reaching the wood, no circumscribing line, circularly rupturing the epidermis, mostly about .3 mm. in diameter. Perithecia one, two or three in a stroma, white in cross-section, .1–.2 mm.; ostiola when visible short, blunt. Asci comparatively few in a perithecium 75–90 × 15 μ, paraphysate. Sporidia subbiseriate hyaline, uniseptate, constricted, quadrinucleate, straight or slightly curved, ends rounded, 18–24 × 6–7 μ.

On dead stems of wild rose, *Rosa* sp. Vancouver Island, July, 1916, *John Macoun, 923.*

8. DIAPORTHE OXYSPORA (Peck) Sacc.

Valsa oxyspora Peck, Ann. Rep. N. Y. State Mus. **28**: 75. 1876.
Valsa ocularia Cooke & Ellis, Grevillea **6**: 11. 1877.
Diaporthe epimicta Ellis & Ev. N. Am. Pyrenom. 439. 1892.

Comparison of the type of *D. oxyspora* (Peck) Sacc. with specimens named respectively *D. ocularia* and *D. epimicta* by Mr. Ellis and some recent collections leads to the conclusion that these names are synonyms. Of my *1645* found on *Ilex* in 1890 which Mr. Ellis first took to be a *Diatrype,* he later wrote that it was a new species which he proposed to name from *epimiktos*—confused—separating it from *D. ocularia* on account of the appendiculation of its sporidia. The appendages are not, however, constant or persistent, for I have specimens from a single brush pile of *Ilex,* showing them to be distinct or obscure or lacking. Prof. Peck's type was reported "on oak limbs" but Dr. H. D. House has found that the host material was *Nemopanthes.*

9. **Protoventuria vancouverensis** sp. nov.

Perithecia scattered, carbonous, thin, globose to conic, bristly, 120–150 μ; bristles rigid, acuminate, pungent, 30–55 × 4–6 μ at base. Asci fusoid-cylindric, straight or curved, 45–55 × 14 μ; paraphyses linear, longer than asci, not abundant. Sporidia fuliginous, 2–3-seriate, uni-septate, bi- tri- or quadrinucleate, the upper cell wider than the lower one and often containing one large nucleus when the narrower, lower cell contains two, 14–15 × 4.5–5 μ.

On dead maple bark (*Acer* sp.). Vancouver Island, August, 1916, *John Macoun, 1003.*

10. MASSARINA DRYADIS Rostr. Meddel. Groenl. 3 : 560. 1888.

Plants of *Dryas octopetala* (L.) much discolored were collected by Mr. F. Johansen, of the Can. Arc. Expedition, near the mouth of Coronation Gulf, July, 1916. The oldest and most sered leaves bore numerous, dark-brown, sphaeroid-depressed to conic, membranaceous, partially immersed perithecia containing asci and sporidia agreeing exactly with Rostrup's description. The ostiola, however, instead of being "niveo" were merely whitish and that only when more or less perforate. The sporidia—not reported by Rostrup—were mostly about $30 \times 15\,\mu$ and the asci while mostly about $100 \times 33\,\mu$ varied in length from 60 to $150\,\mu$. Rostrup's fungus is listed in synopses of North American species of *Massaria* but if Mr. Johansen's plant is the same, and it probably is, the fungus is not a good *Massaria*.

11. **Leptosphaeria Gaultheriae** sp. nov.

Perithecia scattered, black, seated on the cortex and erumpent through the thin cuticle or quite superficial where the latter is thrown off, ovoid-conic to globose, 115–$275\,\mu$ in diameter. Ostiola short, black, conic, shining. Asci broad-linear, 75–80×6.5–$7\,\mu$, paraphyses present, simple or divided. Sporidia pale brown, uniseriate, overlapping, 3-septate, larger in upper half, 12–$16 \times 5\,\mu$.

On dead stems of *Gaultheria Shallon* Pursh, Vancouver Island, August, 1916, *John Macoun 980.*

12. **Asterina** (*Asterella*) **fumagina** Dearn. & Barth. sp. nov.

Perithecia epiphyllous, gregarious or nearly covering the leaf with a sooty layer resembling *Fumago;* seated on dichotomous, anastomosing mycelium of brown, septate hyphae, 5–$6\,\mu$ thick; crowned with 1–3 pungent, dark-brown, rigid setae, 100–400×4–$9\,\mu$; rugose, dark-brown, globose, .3–.5 mm. in diam. Asci sessile, short-elliptic to pyriform, 45–60×25–$30\,\mu$, wall $3\,\mu$ thick, few to 10 in a perithecium. Sporidia hyaline, grumous-nucleate, clavate-oblong, 1-septate, variable in size, 15–25×8–$12\,\mu$, upper cell larger than the lower.

On living leaves of *Panicum latifolium* (?), Maricoa, Porto Rico, Jan., 1913, *F. L. Stevens.* Ex. Herb. of E. Bartholomew *190.*

13. LOPHIOSTOMA EXCIPULIFORME (Fr.) Ces. & DeNot. Comm. Soc. Crit. Ital. **1**: 219. 1863

"We have seen no American specimens of the normal form on bark of deciduous trees."—Ellis & Ev. N. Am. Pyrenom. *222*. Their variety *abietis* differs in having larger spores up to 75 μ and narrower ostiola. Mr. S. H. Burnham's *117* on maple bark collected at Hudson Falls, N. Y., agrees well with the description based on Rehm's *238*. The nearly superficial perithecia with prominent ostiola enlarged at the top, the 6–7 septate, non-constricted sporidia mostly about 33–35 $\times$ 9–10 μ with subhyaline end cells, leave no room to separate this from the European forms.

14. **Phacidium Gaultheriae** sp. nov.

Apothecia scattered, conspicuous by their dark color on the whitened stems of the host, stellately ruptured, .75–1.25 mm. The whitened areas upon which the apothecia are seated extend wholly or partially around the stem and are bounded by a raised line. Asci cylindric-clavate, 90–110 $\times$ 10–12 μ; paraphyses abundant, linear, some of them branched. Sporidia hyaline, grumous or uninucleate, obliquely uniseriate or sub-biseriate, 19–22 $\times$ 6–6.5 μ.

On living stems of *Gaultheria Shallon* Ph.; Vancouver Island; August, 1916, *John Macoun 978*.

15. HELVELLA SPHAEROSPORA Peck, Ann. Rep. N. Y. State Mus. **27**: 106. 1875. **31**: 59. 1879. **47**: 43. 1894. and Bull. **51**: 299. 1897

This rare and interesting species well marked by its globose spores was found in quantity on old sawdust heaps near the Ottawa River, June, 1917, by Mr. W. S. Odell. Dr. F. J. Seaver reports its recent collection by Prof. Orton in Vermont.

16. **Exoascus Aceris** Dearn. & Barth. sp. nov.

Spots subcircular or irregular, .5–1.5 cm., reddish-gray on the upper side, paler beneath, deciduous. Asci numerous, hypophyllous, short-clavate or cylindric, mostly about 30 $\times$ 9 μ. Sporidia hyaline, sub-globose or irregular, 4.5–6 $\times$ 3–4.5 μ.

On living leaves of *Acer grandidentatum* Nutt., Parley's Canyon, Utah, June, 1915. *Bartholomew* and *Garrett 5839*. Type collection, Fungi Columb. *5018*.

17. CALVATIA CRETACEA (Berk.) Lloyd, Myc. Notes 650, f. 929. 1917

Lycoperdon cretaceum Berk., Jour. Linn. Soc. **17**: 18, 1878.

Peridium subglobose, 4–5 cm., the prominent warts of the upper cortex gradually reduced on sides and base to a granular or pruinate layer; sterile base shallow, radicating; spores echinulate, average 6.2 μ, capillitium olive-brown, 12 μ thick, branches much smaller (6 μ).

Collected on the Can. Arc. Exped., 1913–'16, on tundra slopes of the Mackenzie Delta (*O'Neill*), and on Herschell Island and around Coronation Gulf. *F. Johansen.*

This would seem to be a common species in the tundra near 70° N. Lat. The spores show that it cannot be *C. coelata* Bull. which it otherwise approaches. The likely supposition that it might be *C. arctica* F. & W. was rejected on comparison with the details of warts, capillitium, basidia and spores given in the fine plate in Meddelelser om Groenland 43. I referred a description under the MS. name *C. borealis* to Mr. C. G. Lloyd who fortunately had examined and photographed Berkeley's imperfectly described *Lycoperdon crustaceum* collected in the Nares' Expedition. This with material from Lapland, per Thore C. E. Fries, enabled him to establish the above determination.

18. **Phyllosticta brunnea** Dearn. & Barth. sp. nov.

Spots ashy but receiving a brownish cast from the numerous pycnidia; immarginate, .5–1 cm. in diameter. Pycnidia epiphyllous, reddish-brown, very numerous, crowded, depressed, 90–150 μ. Conidia hyaline, oblong, 4–6 $\times$ .75–1 μ.

On languishing, yellowish leaves of *Populus angustifolia* Jas., Montrose, Colo., Oct. 1912. *E. Bartholomew 5001.* There are also on all the leaves darker, more opaque, sterile spots. Type collection, Fungi Columb. *5040.*

19. **Phyllosticta smilacina** (Peck) comb. nov.

Sphaeropsis smilacina Peck, Ann. Rep. N. Y. State Mus. **33**: 24. 1883.

Phoma smilacina (Peck) Sacc. Syll. Fung. **3**: 160. 1884.

Marcophoma smilacina (Peck) Berl. & Vogl. Sacc. Syll. **10**: 205. 1892.

Ascochyta Smilacis Ellis & Mart. Amer. Nat. **16**: 1002. 1882.
Stagonospora Smilacis (Ellis & Mart.) Sacc. Syll. Fung. **3**: 450. 1884.
Phyllosticta Smilacis Ellis & Mart. in Herb. 1898; in Ellis & Evrht.'s N. Amer. Phyllostictas 72. 1900.
Phyllosticta Smilacis Ellis & Ev. Bull. Torrey Bot. Club **27**: 572. 1900.

Prof. Peck described this species on *Smilax rotundifolia* as follows: "Spots orbicular, 2 to 3 lines broad, arid, whitish with a dark border; perithecia epiphyllous, subhemispherical or depressed, black, often disposed in a circle near the margin of the spot; spores oblong or subfusiform, colorless, .0008 in. to .0012 in. long, about .0003 in. broad."

Ellis & Ev. *op. cit.* "Perithecia epiphyllous, 110–150 μ; sporules oblong-fusoid, hyalin, mostly nucleate, subinequilateral, 12–15 × 3.5–4 μ" adding that it is found on various species of *Smilax* and varies considerably in the size and shape of the sporules.

There are before me specimens, including types or co-types, from over twenty widely separated collections bearing one or other of the above names. The spots are, except in Fungi Columb. *4247*, uniformly whitish becoming dingy near the rusty-brown, raised border. On a Niagara specimen out of one spot spores measured 9 × 6 μ, 10 × 5 μ, 15 × 8 μ and 18 × 6 μ. On a leaf of one of the type collections they ranged from 9 × 5.5 μ to 24 × 6 μ; in another spot on the same leaf they were pretty uniformly 7–9 × 6–7 μ. On the spots the pycnidia are mostly sub-circinate but often more or less scattered and mostly but not always epiphyllous. The sporules are sub-globose to oblong-fusoid or inequilaterally elliptic, hyaline, grumous, often nucleate, sometimes *appearing* septate, 7–24 × 4–8 μ, usually within 8–12 × 4–7 μ.

20. **Macrophoma Salicis** Dearn. & Barth. sp. nov.

Pycnidia thickly distributed, sometimes gregarious or seriate, cortical, rupturing the cuticle in a cleft or stellate manner, .25–.5 mm. in height and diam. Ostiola thick, short or longer up to .3 mm. Conidia hyaline, continuous, ovoid to oblong or fusoid, 12–16 × 6–9 μ.

On dead twigs of *Salix exigua* Nutt., Billings, Mont., Aug., 1913, *E. Bartholomew 5207.*

21. **Macrophoma ulmicola** Dearn. sp. nov.

Pycnidia thickly scattered, 1 per sq. mm., surrounding the branches, raising the epidermis into transversely ruptured pustules, immersed in the cortex, not reaching or discoloring the wood, globose, .3–.5 mm. in diameter, ostiola short, hardly visible through the ruptured epidermis. Conidia abundant, hyaline, granular, ovate, 18–30 × 15–18 μ, wall 2–2.5 μ thick, on short conidiophores.

On dead branches of *Ulmus americana* L., Hudson Falls, N. Y., March, 1916, *S. H. Burnham 126.*

Sometimes two or three pycnidia are confluent then suggesting *Dothiopsis* but they are normally and mostly single and separate.

22. **Cicinnobolus major** Dearn. & Barth. sp. nov.

Pycnidia amphigenous, amber-colored, sometimes so numerous as to impart their color to the whole surface of the leaf, on a dense, white mycelial subicle, limoniiform, 75–120 × 30–45 μ. Spores hyalin, continuous, 6–8 × 3 μ.

On *Oidium* on living leaves of *Grindelia squarrosa* (Ph.), Billings, Mont., Aug., 1913, *E. T. & E. Bartholomew 5024.* Type collection, Fungi Columb. *5007.*

C. Cesatii, fide Saccardo, has spores 2.5–3 × 1 μ.

23. **Sphaeropsis Diospyri** Dearn. & Barth. sp. nov.

Pycnidia seated in the dead cortex, .3–.4 mm., so closely clustered in some places as to cover the twig and suggest a *Haplosporella.* The white core around which the brown conidia tardily develop is Phoma-like and produces numerous minute hyaline spores. Conidia brown, 20–25 × 7–10 μ usually with a median nucleus that gives them the appearance of being septate.

On dead twigs of *Diospyros Virginiana* L., Shreveport, La., Oct., 1913, *E. Bartholomew 5458.* Type collection, Fungi Columb. *5088.*

24. **Sphaeropsis latispora** (Peck) sp. nov.

Sphaeropsis Smilacis Ellis & Ev. var. *latispora* Peck, Bull. N.Y. State Mus. **150**: 39. 1910.

Sphaeropsis Smilacis Ellis & Ev. is a *Melanconium.* Prof. Peck's var. on *Smilax hispida* founded on a collection by Dr. Fairman in Yates Co., N. Y., 1909, is a good *Sphaeropsis.* The pycnidia are thickly scattered, .25 mm. in diameter, minutely puncturing the epidermis. "Conidia 17–20 × 11–13 μ"—Peck. Exceptional spores vary from 12–25 μ in length and in shape from globose to oblong-elliptic. Collections examined, Kansas, 1906, *Bartholomew;* London, Ont., 1895, *Dearness;* Long Island, N. Y., 1916, *House.*

25. **Haplosporella Burnhami** sp. nov.

Stromata irregularly globose to linear, 2–10 mm. Pycnidia partly immersed, connate at base, their position indicated by narrow rifts in the bark, mostly about .2 mm. in diameter; ostiola various, a mere perforation or a cylindric or conic beak; flesh whitish at first, becoming gray. Conidia oblong-elliptic with rounded ends or pyriform, brown at maturity, 1–2-nucleate, 18–24 × 10–12 μ; conidiophores rather stout, some of them as long as the spores.

On dead stems of *Rhus Toxicodendron* var. *radicans* (L.,) Torr., Washington Co., N. Y., May, 1916, *S. H. Burnham 112.*

Sphaeropsis Sumachi (Schw.) Cooke & Ellis is described as having subconfluent perithecia in dark stromata,—so possibly it may be a *Haplosporella.* Mr. Burnham's material has been compared with specimens on *Rhus glabra* and *R. hirta* named *S. Sumachi* by Dr. Peck and by Mr. Ellis. There seems more difference in the specimens than is implied in the descriptions.

26. **Septoria samarae-macrophylli** Dearn. & Barth. sp. nov.

Spots conspicuous, reddish-brown, subcircular areas in the wings of the samarae, 2–5 mm. in diameter. Pycnidia pale, thin-walled, 80–120 μ. Sporules numerous, continuous or 1–2 septate, some of them minutely guttulate, 30–65 × 2–2.5 μ, less curved and thicker than in *S. aceris-macrophylli* Peck; spots quite distinct from those of *S. circinata* Ellis & Ev. and from *S. samarae* Peck on keys of *Acer negundo.*

On green samarae of *Acer macrophyllum* Ph., Duckabush River, Wash., Aug., 1912, *E. Bartholomew 4858.* Type collection, Fungi Columb. *5086.*

27. **Septoria Sarcobati** Dearn. & Barth. sp. nov.

Pycnidia nearly black, immersed in the somewhat reddened calyx wings, amphigenous, sometimes widely perforate, with the spores issuing in pale cirrhi; 90–200 μ in diam., wall thin. Sporules straight or curved, obtuse, 1-septate, 30–45 × 5–6 μ.

On calyx wings of *Sarcobatus vermiculatus* (Hook.) Torr., Tromberg, Mont., Sept., 1913, *E. Bartholomew 5324*.

28. (?) **Melasmia Menziesiæ** Dearn. & Barth. sp. nov.

Stromata externally black, reticulated over a yellowed area, .5–1 cm., epiphyllous, consisting of a whitish, pseudo-prosenchymatic layer about .3 mm. thick; the sporiferous tissue in radiating, narrow ridges. Conidia 3 × 1 μ or less on a basidial stratum 8–10 μ in depth.

On living leaves of *Menziesia ferruginea* Sm., Duckabush, Wash., Aug., 1912, *E. Bartholomew 4845*. Type collection, Fung Columb. *5035*.

29. **Leptothyrella Caricis** Dearn. & Barth. sp. nov.

Pycnidia carbonous, dimidiate, astomous, superficial, .2–.7 × .2–.3 mm. One or a few short bristles are found on an occasional pycnidium. Sporules hyaline, 20–25 × 3–4 μ, obscurely 1-septate, in some instances appearing 2–3-septate.

On withered leaves of *Carex stricta* Lam., Stockton, Kansas, May, 1913, *E. Bartholomew 5019*. Type collection, Fungi Columb. *5031*.

30. **Gloeosporium Ailanthi** Dearn. & Barth. sp. nov.

Spots circular, .5–1 cm., bordered, grayish-brown, similar beneath except that the border is not definite, often confluent, circinately ridged. What may be *Cercospora glandulosa* Ellis & Kellerm. is on the same spots. Acervuli epiphyllous, large, 180 μ, dark, waxy. Spores hyaline, oblong with rounded ends, some of them appearing septate probably due to grumous particles gathering towards the ends and leaving a clear space near the middle, 11–16 × 5–7 μ, mostly about 13 × 6 μ.

On living leaves of *Ailanthus glandulosa* Desf., Shreveport, La., Oct., 1913, *E. Bartholomew 5400* (b). Type collection, Fungi Columb. *5021*.

This possibly attacks the leaves only after they are weakened by the *Cercospora* which accompanies it.

31. **Gloeosporium Bartholomaei** sp. nov.

Spots numerous, sooty, quadrate, 1–3 mm. across, paler below but nearly similar, opaque when held to the light. Acervuli amphigenous but mostly epiphyllous, the spore-masses waxy, honey-colored, in crateriform ruptures of the epidermis. Spores fusoid, subacute, hyaline, the nucleation causing some of them to appear septate, $20–24 \times 5.5–6\,\mu$, extremes in length 15 to $30\,\mu$, in width $4–6.5\,\mu$.

On living leaves of *Ribes bracteosum* Dougl., Port Orchard, Wash., July, 1912, *E. Bartholomew 4763*. Type collection, Fungi Columb. *5022*.

32. **Gloeosporium Betae** Dearn. & Barth. sp. nov.

Spots circular, conspicuously circinate, dark-gray, sometimes confluent and then large areas of the leaves become sordid yellow, similar on both sides, .5–1 cm. Acervuli innate; even when their positions cannot be detected with the lens, sections in water usually give one or more oozing cirrhi of spores. Spores abundant, hyaline, minutely nucleate, $3.5–5 \times 3–4\,\mu$.

A typical *Gloeosporium* on living leaves of sugar beet, *Beta vulgaris* Willd., very destructive. Billings, Mont., Aug., 1913, *E. Bartholomew 5173*. Type collection, Fungi Columb. *5023*.

33. **Gloeosporium Crataegi** Dearn. & Barth. sp. nov.

Spots circular, white above with a diffuse, reddish border, reddish when held to the light and on the under side of the leaf, 2–3 mm. in diameter. Acervuli epiphyllous, circular ($60–90\,\mu$) to hysteriiform (.5–1.5 mm. by $60–100\,\mu$), the sporiferous factors with the spores rupturing the cuticle and rising in a mass from .6 to 1 mm. above the level of the leaf. Conidia hyaline, often nucleate at each end, $4–6 \times 2–3\,\mu$.

On living leaves of *Crataegus brevispina* (Dougl.) Heller, Vancouver, Wash., Sept., 1912, *E. Bartholomew 4957*. Type collection, Fungi Columb. *5024*.

34. **Melanconium Smilacis** (Ellis & Ev.) comb. nov.

Sphaeropsis Smilacis Ellis & Ev. Jour. Myc. **5**: 149. 1889.

Examination of a portion of the type collection, H. J. Webber's

34, 1888, on *Smilax hispida* at Lincoln, Nebraska, fails to reveal any pycnidial wall. Irregular acervuli develop just beneath the cuticle rupturing it sometimes at more than one point. Conidia with nuclei half to three fourths of their size, oblong with rounded ends, 9–20 × 6–7 μ, mostly 16 × 6 μ, are mixed with enucleate, subinequilateral ones 7–10 μ wide.

35. **Marssonina bracteosa** Dearn. & Barth. sp. nov.

On arid, brownish areas of the leaves and discolored petioles, not definitely limited. Acervuli yellowish, epiphyllous, seated on the veins and veinlets, .1–.2 mm. Spores hyaline, in hemispheric masses, mostly 1-septate, some of them continuous or septum not discernible, 4–8 × 2–2.5 μ.

On living leaves of *Ribes bracteosum* Dougl., affected with *Gloeosporium Bartholomaei* Dearn., Fungi Columb. *5022*, the acervuli as well as the spores of the latter being much larger than those of the *Marssonina*. Port Orchard, Wash., July, 1912, *E. Bartholomew 4763* (a).

36. (?) SEPTOGLOEUM NUTTALLII HARK.

The following description was written out under the proposed name *Cylindrosporium Osmaroniae* sp. nov.; but it seems to be very close to *Septogloeum Nuttallii* Hark. Jour. Myc. **1**: 117, if not identical with it.

An affected part of the leaf is somewhat paler than the adjacent area and when such part is held to the light and examined with a lens the acervuli are visible as opaque dots each surrounded by a narrow translucent ring. These may become confluent and appear as brown spots 2–3 mm. in diameter. Acervuli amphigenous but mostly hypophyllous, 50–100 μ in diameter, usually more prominent at the margin than in the center, yellowish, resembling young uredosori. Conidia hyaline, 1–several-septate, mostly 1-septate, usually multinucleate, subarcuate and subacute, 30–50 μ, mostly 45 × 3 μ.

On living leaves of *Osmaronia cerasiformis* (T. & G.) Greene, Vancouver Island, July, 1916, *John Macoun 933*.

37. **Septogloeum Schizonoti** sp. nov.

Spots numerous, irregular, scattered, dark-brown, 1–5 mm., mostly in indefinite areas that become orange or reddish and often extending over the whole leaf. Acervuli amphigenous but mostly epiphyllous, nearly concolorous, the larger ones with a prominent rim and depressed disc, 75–200 μ. Sporules hyaline, subarcuate, 30–45 $\times$ 5–7 μ, mostly 2-septate.

On living leaves of *Schizonotus discolor* (Pursh) Raf. Vancouver Island, August, 1916, *John Macoun 969.*

This may be only a variety of the preceding species.

38. **Septogloeum Salicis-Fendlerianae** Dearn. & Barth. sp. nov.

The spots are somewhat arid, subcircular areas, 2–4 mm., bounded by an unbordered, raised line, more distinct on the upper side of the leaf. Acervuli amphigenous but mostly epiphyllous, pycnidia-like in the younger stages but developing into circular, yellowish-hyaline depressions, 100–150 μ. Sporules hyaline, grumous, curved, mostly 1-septate, 15–50 $\times$ 3.5–6 μ, mostly about 45 $\times$ 5 μ.

On living leaves of *Salix Fendleriana* Anders., Caldwell, Idaho, Sept., 1912, *E. Bartholomew, 4968.* Type collection, Fungi Columb. *5085.* Many of the leaves in this collection bear numerous brown, angular spots which mark the areas occupied by the *Septogloeum.*

Fungi Columb. *3779* and *4387* are this species. It is quite distinct from *Septogloeum salicinum* (Peck) Sacc.; indeed it comes nearer *Cylindrosporium salicinum* (Peck) Dearn.

39. **Cylindrosporium Artemisiæ** Dearn. & Barth. sp. nov.

Spots brown, angular, following the veins, becoming confluent, indistinctly visible through the tomentum on the lower side of the leaf. Acervuli numerous, epiphyllous, concolorous, 60–90 μ. Sporules hyaline, subclavate, subflexuous, 1–5-septate, 20–50 $\times$ 3–4 μ.

On living leaves of *Artemisia Suksdorfii,* Piper, Pleasant Beach, Wash., August, 1912, *E. Bartholomew, 4892.* Type collection, Fungi Columb. *5010.*

40. **Cylindrosporium salicinum** (Peck) comb. nov.

Septoria salicina Peck. Ann. Rep. N. Y. State Mus. **25**: 87. 1873.
Septoria albaniensis Thüm. Bot. Gaz. **5**: 122. 1880.
Phleospora Dearnessii Sacc. 1914.

In Mycologia **8**: 105, I drew attention to the confusion in the names of *Cylindrosporium* on *Rhus* spp. due to the wide variation in size of the spores and the uncertainty as to whether they are formed in a true pycnidium.

Similar confusion obtains in respect to the names of species parasitic on the leaves of *Salix* spp. which in my own herbarium is labelled *Cylindrosporium salicinum* Ellis & Ev. sp. nov. in litt., Sept., 1892. This name was not published because the late Mr. J. B. Ellis on further study concluded that it "was too near *Septoria albaniensis* Thüm." In 1873 Prof. Peck published *Septoria salicina*, on *Salix lucida*, Ann.Rep. N. Y. State Mus. **25**: 87. 1873. *Septoria albaniensis* Thüm., on *Salix lucida* was published in Bot. Gaz., Oct., 1880. Careful comparison of authentic material—types or co-types—of the foregoing failed to reveal a satisfactory means of distinguishing them.

Co-type of *Phleospora Dearnessii* Sacc., on *Salix nigra*, published in 1914, Ann. Myc. **12**: 299, cannot be separated with certainty from the preceding. Dr. Saccardo remarked that this species verges on *Marssonia*, but the sporules favor *Phleospora* and further that it may not be different from *Septoria albaniensis* Thüm. and *S. salicina* Peck, the descriptions of which are inadequate for a decision. In the apparently earlier stages their discolorous pustules bear a resemblance on the surface to pycnidia but finally they become nearly concolorous and are visible as circular depressions or cavities rupturing usually, not always, through the lower cuticle of the leaf.

Fungi Columb. *3872*, incorrectly labeled *Septogloeum salicinum* (Peck) Sacc., has somewhat larger sporules and some of the spots are larger and conspicuously circinated or mottled. The differences, taking a large number of specimens into account, are insufficient for a new form-species. It might, however, pass for a variety, say var. *circinatum*.

The form in Fungi Columb. *3779* and *4387*, both on *Salix Fendlieriana,* incorrectly labeled *Septoria Salicis* West., differs from all the preceding in its larger sporules. It is less distinctly maculate and almost completely epiphyllous. (*Septogloeum Salicis-Fendlerianæ* sp. nov.)

Examination and comparison of all the available material seems to justify the following determinations:

Cylindrosporium salicinum (Peck) Dearness (=*Septoria salicina* Peck on *Salix lucida.* Acervuli mostly hypophyllous, on arid centers of spots; sporules about $38 \times 3\text{–}3.25\,\mu$, obscurely 1–3 septate. Ellis & Ev. N. Am. Fungi, *2646, 3064, 3369;* Fungi Columb. *284, 2081.*

f. *albaniensis* (Thüm.) on *Salix lucida.* Maculæ less distinct; sporules usually straight about $33 \times 2.75\text{–}3\,\mu$. Seym. & Earle Ec. Fungi *197;* Fungi Columb. *1346.*

var. **circinatum** var. nov. on *Salix lucida.* Maculæ .5–1.5 cm. mostly circinate or mottled; sporules $40 \times 3\text{–}3.5\,\mu$. This is Fungi Columb. *3872.*

Septoria Salicis West., as exhibited in Roumeguère's Fungi Gallici *3843,* and *S. salicicola* Sacc., in de Thümen's Myc. Univ. *1993,* have true pycnidia and are quite different from any American species of *Septoria* on willow that I have seen. In both, the spots are small, about 1 mm., the pycnidia nearly black and mostly epiphyllous.

In this connection it may be worth while to report briefly the results of the examination of three other allied form-species on willow leaves. See No. 41.

41. GLOEOSPORIUM SALICIS West. Fungi Columb. *855, 4122;* N. Am. Fungi *2441.*

Supplementary to description in Jour. Myc. **1**: 113. 1885.

Maculae numerous, small, angular, acervuli epiphyllous. Sporules $15\text{–}23 \times 7.5\text{–}10\,\mu$ mostly 2-nucleate.

Gloesosporium boreale Ellis & Ev. on *Salix cordata* Fungi Columb. *682*; N. Am. Fungi *3279.*

Supplementary to Proc. Acad. Phila. **1893**: 459. 1893.

Acervuli hypophyllous. Spores issue in cirrhi, simple, $7\text{–}12 \times 1.5\text{–}2\,\mu$.

Septogloeum salicinum (Peck) Sacc.
(*Gloeosporium* Peck). On *Salix sericea.*

Supplementary to the description in Ann. Rep. N. Y. State Mus. 33: 26. 1883.

The indefinite, "arid," spore-producing parts seem to develop from precedent, dull-purplish areas. Acervuli hypophyllous, irregularly rupturing the cuticle and delivering the spores in yellowish heaps rather than in cirrhi. Sporules grumous, or granular, no nucleate ones observed, 10–50 × 3–6 μ mostly about 45 × 5 μ, continuous or 1.3 septate, mostly 1-septate, the proximal half rounded on the end, 4–6 μ thick, the other half acuminate to a subacute point and curved.

Septogloeum maculans Hark. on *Salix lasiolepis.*

Jour. Myc. 1: 117. This is quite distinct and seems to be the conidia of a dark, radiating fungus in the interior of the leaf.

42. **Cryptosporium candidum** nom. nov.

A species of *Cryptosporium* on *Abies* was published in *Mycologia* 8: 107 under the preoccupied name *C. falcatum.* It is hereby changed to *C. candidum.* The name refers to the white flecks of exuded spore-masses on the dark bark of the host which draw attention to the presence and location of the fungus.

43. **Fusoma rubricosa** Dearn. & Barth. sp. nov.

Minute, brown, elongate spots, 1 × .2 mm. indicate the points of infection of the host; red areas extending from these spots become confluent and impart their color to the leaf. Both sides are similarly reddened but the lower side is white-specked with the flake-like colonies of conidia. Conidia hypophyllous, hyaline, shuttle-shaped, 3 septate, 35–45 × 11–15 μ, subsessile or borne on short sporophores, 9–18 × 4–5 μ.

On living leaves of *Calamagrostis scabra* Presl., Glacier National Park, Mont., Aug., 1915, *E. T. Bartholomew.* Type collection, Fungi Columb. *5019.*

44. **Ramularia Clematidis** Dearn. & Barth. sp. nov.

Spots pallid, irregular, mostly bounded by the veinlets, paler when held to the light than the unaffected portions of the leaf, slightly reddened on the under side by the conidia. Hyphae short, on colorless, flattish bases. Conidia hyaline, having a reddish tint in the mass, continuous or 1-septate, 20–30 × 4–7 μ.

On living leaves of *Clematis ligusticifolia* Nutt., Billings, Mont., Aug., 1913, *E. T.* and *E. Bartholomew 5180*. Type collection, Fungi Columb. *5084*.

45. **Ramularia Ranunculi-Lyallii** Dearn. & Barth. sp. nov.

On the upper side of the leaf, small, irregularly-oblong spots mark the diseased parts. These bear on the lower side numerous acervuli of short sporophores supporting subfusoid, hyaline, continuous conidia, $15–22 \times 2.5–4\,\mu$; and finally becoming a dense, white mould-like layer. These spots may become confluent and the whole lobe or leaf sered.

On *Ranunculus Lyallii* (Gray) Ryd. Bremerton, Wash., July, 1912, *E. Bartholomew*. Victoria, B. C., April, 1915, *John Macoun*.

46. (?) **Cercosporella Aceris** Dearn. & Barth. sp. nov.

Extensive areas, dark-brown above, reddish-brown below, surrounded as seen when held up to the light by a greenish, translucent border, 1–2 mm. wide. Tufts of hyphae and sporules whitish, numerous, superficial, epiphyllous, consisting of long, slender, straight, hyaline, septate sporules $150–200 \times 4\,\mu$, intermixed with thick, short, septate hyalin offshoots from the same base, $15–50 \times 6–10\,\mu$.

Destructive to living leaves of *Acer macrophyllum* Ph., Duckabush, Wash., Aug., 1912, *E. Bartholomew 4817*. Type collection, Fungi Columb. *5005*.

47. (?) **Cercosporella Alni** Dearn. & Barth. sp. nov.

Slightly discolored areas sometimes extending over the whole leaf, hardly visible on the lower side unless held up to the light but well marked on the upper side by the numerous, whitish or yellowish tufts of hyphae and spores. These superficial tufts or masses consist of hyaline, straight, 2–5-septate sporules, $270–360 \times 5–6\,\mu$, intermixed with hyaline, relatively short offshoots $30–100 \times 10–20\,\mu$ from the same base of globular or quadrate cells, $9–14\,\mu$. The second form may develop into the first named, long, straight sporules. The oldest masses seem yellowish, waxy tubercles supporting numerous, long, hyaline sporules.

Destructive to living leaves of *Alnus rubra* Boug., Bremerton, Wash., Sept., 1912, *E. Bartholomew 4924*. Type collection,

Fungi Columb. *5006*. This may be only a host variety of the preceding or *vice versa*.

48. **Cercospora Streptopi** Dearn. & Barth. sp. nov.

Spots yellowish, irregularly oblong, 2–5 mm., bounded by the veinlets, becoming confluent and turning brown. Hyphae 15 μ, on pale, later becoming dark, tubercular bases, mostly hypophyllous. Conidia abundant, 20–63 × 5.5–6 μ, 1–7-septate; they and the fertile hyphae pinkish and imparting to the lower side of the leaf a decidedly pinkish hue.

On living leaves of *Streptopus amplexifolius* (L.) DC., Duckabush River, Wash., Aug., 1912, *E. Bartholomew 4857*. Type collection, Fungi Columb. *5004*.

49. **Helminthosporium repente** Dearn. & Barth. sp. nov.

Extensively creeping and proliferating over the bark,—dark, olive-brown hyphae 5–8 μ thick, cells 6–15 μ long; conidiophores or fertile branches, narrower and paler than the conidia and with longer cells. Conidia sub-oblong, 5–12-septate, dark-brown, nearly opaque throughout, horizontal or ascending, mostly 40–45 × 8–9 μ when mature, exceptionally reaching 60 μ in length, septa 4–6 μ apart.

On bark of dead *Acer grandidentatum* Nutt., Red Butte Canyon, Utah, June, 1913, *E. Bartholomew 5826*.

50. **Fusarium gleditsiaecolum** Dearn & Barth. sp. nov.

Sporodochia salmon-colored, white below the conidiophorous layer, erumpent through the cuticle, seated on the cortex which assumes a reddish tinge on the surface adjoining the wood. Sporules arcuate, hyaline, 1–3-septate, 30–45 × 3–4 μ on more or less branched conidiophores forming a layer 30–100 μ in depth.

On dead *Gleditsia triacanthos*, L., Stockton, Kansas, May, 1914, *E. Bartholomew 5554*.

F. scolecoides Sacc. & Ellis, which this resembles, has 5-septate sporules, 70–80 μ in length.

51. **Fusarium Macounii** sp. nov.

Sporodochia gregarious, whitish with carneous tinge, erumpent-superficial, depressed, irregularly circular to elliptic, walled

around by the ruptured epidermis, .3–.5 mm. in diam. Hyphae fasciculate on a pseudo-parenchymatic base; sporophores simple or more frequently branched, 2.5–3 μ thick. Conidia hyaline, straightish, terminal and solitary on the narrow branches of the sporophores, continuous to 3-septate, not constricted, 20–60 $\times$ 5–6.5 μ.

On deaa maple bark (*Acer* sp.) Vancouver Island, August, 1916, *John Macoun, 1003.*

The conidia are larger and sporophores narrower than in *Fusarium illosporoides* Sacc., to which it is otherwise similar.

LONDON, ONTARIO, CANADA.

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—III

TYÔZABURÔ TANAKA

MASSARIA MORICOLA I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical report of the Imperial Sericultural Experiment Station), Tôkyô, Japan. 1^5: 318, pl. 16, figs. 6, 7, 8. T. 5, xii, Dec. 1916. (Japanese.)

Perithecia thickly scattered, subepidermal, penetrating the epidermis with elongated ostiola, spherical or ellipsoidal, 300–400 μ in diam., 280–372 μ in height, the inside of ostiolum and adjacent area covered by short periphysatic hairs, containing few asci; asci cylindrical or ovoid, short stipitate, 140–200 $\times$ 37–46 μ, paraphysate; ascospores biseriate or irregular, hyaline and unicellular at juvenile stage but quickly developing into 4-celled dark-colored mature spores, the contents of which are first characteristically represented by comparatively large shiny oil globules, soon disappearing and replaced by granular protoplasm scarcely permitting the light to pass through, 52–65 $\times$ 13–17 μ, cylindrical, not constricted at the septum; gelatinous envelope none.

On twigs of *Morus alba* (common).

Type localities: Gifu-ken (prefecture), Kaidzu-gun Kaisai-mura, Mar. 1909, I. Miyake; Fukui-ken (pref.) Ôno-gun and Hida-no-kuni (Gifu prefecture) Mashita-gun, Shimohara-mura, Mar. 1909, K. Hara; Nagano-ken (pref.) Shino-ina-gun, May, 1910, I. Miyake; Tôkyô-fu (pref.) Nakano-chô Jan. 1915, I. Miyake; Tochigi-ken (pref.) Utsunomiya-shi and Fukushima-ken (pref.) Fukushima-shi, Mar. 1915, I. Miyake; Kyôto-fu (pref.) Ayabe-chô, Apr. 1915, I. Miyake.

Illustrations: 3 black and white lithographic figures showing detailed structure of the fungus.

The juvenile acospores very much resemble those belonging to other genera, but close examination of mature spores will show the characteristics of the genus *Massaria*.

MASSARIA JAPONICA I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical report of the Imperial Sericultural Experiment Station), Tôkyô, Japan. 1^5: 319, pl. 16, figs. 9, 10, 11. T. 5, xii, Dec. 1916. (Japanese.)

Perithecia gregarious, subepidermal, with ostiola erumpent, elliptical, 400–500 μ across and 250–320 μ high; perithecial walls pseudo-parenchymatous, 70–100 μ thick, black, walls and bottom surrounding inner space consisting of nearly colorless and sub-transparent cells; asci cylindrical, 130–160 $\times$ 20–25 μ, octosporous, paraphysate; ascospores dark ink-colored, 4-celled, conspicuously constricted at the middle septum, occasionally but not distinguishably so at the other septa, containing one large oil globule in each cell, 30–35 $\times$ 9–11 μ; gelatinous envelope none; paraphyses filiform, about 1 μ thick, abundant, exceeding asci in length.

On twigs of *Morus alba* (not common).

Type localities: Gifu-ken (prefecture) Ena-gun Kashimo-mura, Mar. 1909, K. Hara; Iwate-ken (pref.) Hanamaki-chô, Apr. 1915, I. Miyake.

Illustrations: 3 black and white lithographic figures showing detailed structure.

Easily distinguished under the microscope from other related species by having the inner layers of the perithecial walls nearly colorless and sub-transparent.

KEY TO THE FOUR SPECIES OF MASSARIA ABOVE DESCRIBED[1]

(*A*) Ascospores with gelatinous envelope.
- (*a*) Ascospores 3–5, usually 4-septate .... *M. phorcioides.*
- (*b*) Ascospores 3-septate .... *M. Mori.*

(*B*) Ascospores without gelatinous envelope.
- (*a*) Ascospores not constricted at the middle septum...... *M. moricola.*
- (*b*) Ascospores constricted at the middle septum........ *M. japonica.*

Three species of *Massaria* are already known to be parasitic or saprophytic on *Morus alba,* but all can be distinguished in some way from these four new species.

Massaria epileuca B. and C. is characterized by having asco-

[1] For descriptions of *M. phorcioides* and *M. Mori,* see the second article of this series.

In the description of *M. Mori,* the two following lines were unfortunately omitted in the final printing:

ing of black pseudo-parenchymatous tissue; asci cylindric, shortly pedicelled, 140–160 x 40–50 μ, octosporous, paraphysate;

spores with smaller terminal cells; *M. Antoniae* Far., which is related to our *M. phorcioides* by its ascospores having a large number of cells, can be distinguished by 6– (rarely 7–8) celled spores, instead of 4– (rarely 6–7) celled as in the latter species. *Massaria olivaceo-hirta* Cooke is rather doubtful but may differ in the color and form of ascospores.

MYCOSPHAERELLA HORII K. Hara sp. nov. in Nippon Engei Zasshi (Journ. of Hort. Soc. Japan), **29**^{3}: 10, illus. (p. 9, figs. 1–6). T. 6, iii, Mar. 1917. (Japanese.)

Spots irregularly orbicular, about 3–6 mm. across, reddish-brown and frequently changing to gray when mature; margin definite, raised, blackish-brown, punctated with black, minute perithecia; perithecia gregarious or scattered, punctiform, at first immersed then partly erumpent, black, globose or elliptico-globose, 60–100 μ; perithecial walls pseudo-parenchymatous, cells rather indefinite, about 3–8 μ across, blackish-brown, carbonaceous; ostiola slightly raised, warty or short papillate with openings about 5–7 μ across; asci caespitose, clavate-cylindrical or oblong-ovoid, obtuse, stipitate, octosporous, 30–40 $\times$ 7–10 μ; ascospores biseriate or inordinate, oblong-ovoid, uniseptate, not usually constricted; terminal cell slightly wider and much rounded at the apex; basal cell rather acuminate toward the base though not pointed at the end and nearly as round as the apex, colorless and hyaline, 9–12.5 $\times$ 2.5–3 μ.

On leaves of *Citrus*.

Type locality: Hamana-mura, Inasa-gun, Shidzuoka-ken, Japan, June, 1914, Katarô, Shimidzu.

Japanese name of disease: Kasshoku Ko-maruboshibyô (small, brown, round-spot disease).

Illustrations: 6 text figures showing detailed structure of the fungus.

Dr. Shôtarô Hori, in Engei no Tomo (Friend of Horticulture) **9**^{7}: 40–45, Tôkyô, July, 1913, considers the cause of this disease to be *Phyllosticta curvarispora* Hori sp. nov. As no description of the fungus was given there or elsewhere, there is no way to determine whether this imperfect fungus is a form of *Mycosphaerella Horii*, but the existence of such relationship is suggested as very possible since many species of these two genera are known to be related. The fungus mostly attacks navel and Unshû (Satsuma) oranges, according to Dr. Hori.

Phyllosticta citricola Hori ex K. Hara in Nippon Engei Zasshi (Journ. of Hort. Soc. Japan), 29^3: 11, illus. (p. 9, figs. 7–9). T. 6, iii, Mar. 1917. (Japanese.) First published by Hori as *Phyllosticta citricola* Hori sp. nov. in Engei no Tome (Friend of Horticulture), 9^7: 627, T. 2, vii, July, 1913, but with no description of the fungus, symptoms alone being given.

Pycnidia punctiform, black, first immersed then slightly raised and disclosing the upper end, gregarious or scattered, globose or depressed-globose, 100–130 μ in diam.; perithecial walls membranaceous, cells about 4–7 μ, dark-brown, carbonaceous; ostiola terminal, papillate or even; openings round, about 10–12 μ across; pycnospores globose, ovoid, or short-ellipsoid, 1-nucleate at the middle and very much granulated all over, colorless and hyaline, 6–11 $\times$ 6–9 μ; the spore mass does not seem to form the thread-like protrusion covered with mucilaginous matter.

On leaves of *Citrus*.

Type locality: Toyoda-mura, Abe-gun, Shidzuoka-ken, coll. by Okada, July 6, 1914.

Japanese name of disease: Kasshoku Ô-maruboshibyô (large, brown, round-spot disease).

This disease is reported to have caused great injury to Natsudaidai (Japanese summer orange) in the province of Toyoda-gun, Hiroshima-ken, and also in Abe-gun, Shidzuoka-ken. Hori reported it as also attacking the Unshû (Satsuma) orange.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

NOTES AND BRIEF ARTICLES

Professor W. C. Coker, of the University of North Carolina, continued his studies of the Clavariaceae in the herbarium of the Garden during August.

Mr. L. O. Overholts, of State College, Pennsylvania, was given a research scholarship for August 15 to September 15, to complete his study of the genus *Pholiota* for *North American Flora*.

Mr. Percy Wilson recently collected a specimen of *Tyromyces Spraguei* on the base of a living larch tree growing in the grounds of the New York Botanical Garden. This fungus occurs abundantly on chestnut and oak throughout the northeastern United States, but has never before been reported on a conifer. Mr. Weir found *Grifola Berkeleyi,* an oak-loving species, attacking the roots of larch in Idaho. Possibly the larch is more deciduous than has been supposed!

M. Paul Hariot, author of various works on fungi and algae, and for many years in charge of the cryptogamic collections at the Muséum d'Histoire Naturelle of Paris, died on July 5, from diabetic complications. The broad-minded liberality and tireless patience with which M. Hariot always placed the treasures of his department of the museum at the service of the scientific men of the world will long be held in grateful remembrance by American botanists.

In a recent number of the *Botanical Gazette,* Harry M. Fitzpatrick discussed the development of the ascocarp of *Rhizina undulata.* The Helvellaceae have formerly been separated from the other orders of the discomycetes by the fact that the fruit body is open from the first. The erroneousness of this distinction has been abundantly established by various workers. The

genus *Rhizina* shows no evidence of an enclosing veil at any stage in its development, a fact which has been demonstrated by Fitzpatrick. The sexual apparatus is to be described in a later paper.

A specimen of *Schizophyllus alneus* (L.) Schroet., usually known as *S. commune,* was found on September 3, 1917, by Dr. G. Clyde Fisher, at Douglaston, Long Island, growing on a rotten apple. Several sporophores had emerged from the substratum at three or four points and had just about reached maturity when I saw the specimen. This would seem to indicate that spore germination and development of fruit-bodies may proceed quite rapidly in this species.

"The Cultivation and Diseases of the Sweet Pea" is the title of a book recently published by J. J. Taubenhaus, of the Texas Experiment Station, with an introduction by Mel Cook, of Rutgers College, New Jersey. The book is based largely on the practical experience of the writer and is written in a popular manner so as to appeal to the practical grower. About half of the book is devoted to the culture of the sweet pea and the remainder to the diseases which threaten to discourage the cultivation of this ornamental plant. The various insect and fungous pests are considered in detail with suggestions for their control. The book consists of xx + 232 pages with 46 figures and is printed in large type so as to be easily legible.

A disease of the hemlock tree due to *Fomitiporia tsugina* Murrill was discovered by Mr. Percy Wilson at East Hebron, New Hampshire, in August, 1905. In July, 1917, Mr. Wilson revisited the type locality and gathered specimens from the trunk of the same tree, which was found to be dead and prostrate on the ground. These latter specimens were over an inch thick and broadly effused over the trunk. Living hemlocks recently examined by Mr. Wilson near Bristol, New Hampshire, were also found to be attacked by this fungus, which is known to occur in New Hampshire and New York, always confined to the hemlock. The disease is probably important and should be further investigated both by foresters and mycologists.

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